American Council for Capital Formation

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Executive Summary

Comments by Dr. Margo Thorning, Senior Vice President and Chief Economist, American Council for Capital Formation on "Design Elements of a Mandatory Market Based Greenhouse Gas Regulatory System"

This submission includes responses all four questions included in the White Paper. The American Council for Capital Formation does not know how the Senate can design a mandatory GHG reduction program that is consistent with the Sense of the Senate Resolution -- the program should "not significantly harm the US economy" and should "engage comparable action by other nations that are major trading partners and key contributors to global emissions." Key to addressing climate change is to promote global participation and address climate risks in the context of developing countries -- Fossil fuels provide over 80% of the energy used in the U.S. to maintain our standard of living and promote robust economic growth. That is also the level used globally, which IEA projects will be maintained through 2025. The percentage of global GHG emissions from developed countries continues to decline, while that from developing counties increases with economic growth. There is no credible basis for assuming that major developing countries like China and India would adopt a mandatory program to reduce GHG emissions. Climate policy must address the links between energy use, economic development, international competitiveness and poverty reduction. Technology development and deployment offers the most efficient and effective way to reduce GHG emissions -- There are only two ways to reduce CO2 emissions from fossil fuel use -- use less fossil fuel or develop technologies to use energy more efficiently, to capture emissions or to substitute for fossil energy. There is an abundance of economic literature demonstrating the relationship between energy use and economic growth, as well as the negative impacts of curtailing energy use. Long-term, new technologies offer the most promise for affecting GHG emission rates and atmospheric concentration levels. In the interim, actions to reduce the growth of emissions should focus on the deployment of existing, efficient technologies, particularly in the developing world where current efficiency levels are lower than in the developed world. Use of cap/trade programs to drive GHG emission reductions will have a significant economic impact and creates disincentives for innovation -- Cap/trade systems for greenhouse gas emissions, whether downstream or upstream, would be overly bureaucratic and result in sectoral distortions due to the differential application of caps and/or the selective allocation of credits. These sectoral distortions result in raising the cost of GHG reductions and unfairly favoring or damaging individual business sectors. Cap/trade systems with auctioned credits or 'safety value' government sales of credits are distorted tax systems, incurring the economic damages of a carbon tax without the efficiency of a uniform, economy-wide cost of carbon emissions. Implementation of a carbon tax to drive GHG emission reductions will have a similar economic impact as a cap/trade system -- A carbon tax would raise energy costs significantly and have an economy wide impact. For example, a CO2 price of about $27/MtCO2 (or $100/MtCarbon) is equivalent to about a $10 per barrel increase in oil prices.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Margo Thorning, American Council for Capital Formation

Who is regulated and where?

Clarifying Question 1a:

- Is the objective of building a fair, simple, and rational greenhouse gas program best served by an economy-wide approach, or by limiting the program to a few sectors of the economy?

Response to White Paper Question 1a by Dr. Margo Thorning, Senior Vice President and Chief Economist, American Council for Capital Formation

Answer: The Emission trading system (ETS) put in place in 2005 in the European Union is a sectoral system that relies on a cap and trade system. The ETS requires approximately 12,000 large industrial emitters and utilities to reduce CO2 emissions (or purchase the right to emit CO2) in accordance with their country's Kyoto Protocol targets. The approach to emissions reductions embodied in the EU's sectoral approach has failed to make much of a dent in EU emission growth, but has the potential to make a significant impact on the economies of countries trying to meet their targets. The latest data from the European Environmental Agency shows that the "EU 15" are expected to be 4 percent above their emissions target in 2010 instead of 8 percent below 1990 levels as required under the Kyoto Protocol. There now appears now to be a rift within Europe on climate change policy as Italy and some German industrialists express growing concerns with the impact of the ETS on electricity prices, production costs and competitiveness.

If the EU actually wanted to reduce its emissions to the Kyoto Protocol target, it would have to use an economy - wide approach and cover all sectors, including transportation and households. . Recent macroeconomic analyses on Germany, Spain, UK and Italy by the International Council for Capital Formation show that an economy-wide ETS designed to meet the Kyoto targets would reduce these countries GDP levels and employment significantly in 2010 (see http://www.iccfglobal.org/pdf/Country-reports-overview.pdf)

"Upstream versus "downstream" regulatory approaches.
Answer: Trying to reduce U.S. emissions through a cap and trade system applied at either "upstream" or "downstream" is likely to have serious consequences for the U.S. economy, including reduced GDP and increased unemployment rates. For example, various economic models show that the imposition of the Kyoto Protocol would reduce US GDP levels by 1 to 4.2% annually by 2010 (see Figure 2 at http://www.accf.org/pdf/oregontestimonyfinal.pdf). While the upstream approach is perhaps easier to monitor and enforce because far fewer emitters would be in the system, it suffers from the fact that final consumers won't see the direct impact of the energy tax (or permit price) so their energy and fuel bills. Only the other hand, if a business owner (say a paint manufacturer) who owns equipment which emits CO2 has to submit an emission allowance for each ton emitted, he will be able to make a careful cost-benefit

analysis of when it makes economic sense to replace his capital equipment or make other production related decisions. An obvious question is, if a “downstream “system for reducing CO_2 emissions is impractical (because of millions of small emitting sources, according to the White Paper), and an “upstream” system results in only attenuated decision making on emissions, how efficient would a cap and trade system be in providing emission decision makers with a realistic incentive to efficiently and significantly reduce emissions?

Question 1. Point of Regulation
Submitter's Name/Affiliation: Margo Thorning, American Council for Capital Formation

Clarifying Question 1b:

- What is the most effective place in the chain of activities to regulate greenhouse gas emissions, both from the perspective of administrative simplicity and program effectiveness?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: Margo Thorning, American Council for Capital Formation

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

Response to White Paper Question 2 by Dr. Margo Thorning, Senior Vice President and Chief Economist, American Council for Capital Formation

Answer: As noted in the White Paper, "while the allocation of allowances won't reduce the overall cost of the program, it can shift the cost among participants." It is impossible to offer a serious answer to this question without knowing the overall cost of the program – only then can a serious discussion of "mitigating costs" begin.

Simply put, the white paper's discussion of cost shifting overlooks the overall cost of the program. For example, the White Paper references the NCEP analysis and states that doubling public sector investments in energy R&D by $1.6 billion and increasing the incentives for early deployment by $1.4 billion (for a total of $3 billion) could be paid for out the proceeds of the sale of 5 to 10% of the pool of allowance permits. This implies a cost for the permits of $30 to $60 billion per year. While this is a significant burden by itself, the direct cost of permits to emit GHGs is only part of the picture. For example, the US capital stock would become prematurely obsolete by the rise in energy prices caused by the need to acquire allowances. A 2005 economic study by CRA International showed that imposing the NCEP targets on the US economy reduced GDP levels by $27 billion (in real terms) by 2020 and would produce smaller reductions than the goal of the President's ongoing voluntary program while creating unnecessary new bureaucracy, new vested interests and large tax-like wealth transfers (see link at http://www.accf.org/publications/reports/revisedmcainlieberman.html)

Furthermore, the White Paper states that "even very aggressive emission policies undertaken today are unlikely to fully mitigate the impacts of future warming. This statement raises the question of whether other policies (besides cap and trade) to reduce GHGs should be evaluated to compare their relative costs and benefits in terms of GHG reductions or reduced GHG intensity.

Question 2. Allocation
Submitter's Name/Affiliation: Margo Thorning, American Council for Capital Formation

Question 3. International Linkage
Submitter's Name/Affiliation: Margo Thorning, American Council for Capital Formation

Should a U.S. system be designed to eventually allow for trading with other greenhouse gas cap-and-trade systems being put in place around the world, such as the Canadian Large Final Emitter system or the European Union emissions trading system?

Response to White Paper Question 3 by Dr. Margo Thorning, Senior Vice President and Chief Economist, American Council for Capital Formation

Answer: Many cap and trade proponents would like to develop a system that would link the US to other countries including the European Union's Emission Trading System or the Canadian Large Final emitter system. However, as a new study by Dr. David Montgomery of CRA International shows, a global emission trading system is not workable. (See pages 65-79 at http://www.iccfglobal.org/research/climate/climate-change-book.html.)
Emission trading will work only if all the relevant markets exist and operate effectively; all the important actions by the private sector have to be motivated by price expectations far in the future. Creating that motivation requires that emission trading establish not only current but future prices, and create a confident expectation that those prices will be high enough to justify the current R&D and investment expenditures required to make a difference. This requires that clear, enforceable property rights in emissions be defined far into the future so that emission rates for 2030, for example, can be traded today in confidence that they will be valid and enforceable on that future date.

The international framework for climate policy that has been created under the UNFCCC and the Kyoto Protocol cannot create that confidence for investors because sovereign nations have different needs and values. Therefore, it seems likely that the ETS system, which the EU is trying to implement, will fail to spread to other parts of the world and will eventually be replaced with a more practical approach to climate change policy.

Another difficult challenge in the linking of international GHG trading systems stems from the large potential wealth transfers. For example, if global emissions were 25 billion metric tons CO2 (approximately today's level of total emissions), valuing those emissions at $20/Mt CO2 (below recent CO2 prices in the EU-ETS) implies a global market value of $500 billion/year. This would then have to be allocated among countries, to say nothing of allocating them within countries. It would be a huge and complex political process to allocate that amount of resources (wealth) among the countries of the world. Any allocation process will result in "winners" and "losers" and the best judge has always been the free market rather than governments.

Perhaps an even more difficult problem in making an international allocation system work stems from widely divergent population trends that would require continuous renegotiation of caps and allocations among countries. For example, over 2002-2025, population growth in the US (21%), India (29%), and China (11%) vastly exceed populations change in Western Europe (1%) and Japan (-3%) (Energy Information Administration projections from the *International Energy*

Outlook 2005.) These divergent population trends raise serious practical questions about the political viability of linked trading systems, whatever their theoretical desirability.

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Margo Thorning, American Council for Capital Formation

If a key element of the proposed U.S. system is to "encourage comparable action by other nations that are major trading partners and key contributors to global emissions," should the design concepts in the NCEP plan (i.e., to take some action and then make further steps contingent on a review of what these other nations do) be part of a mandatory market-based program? If so, how?

Response to White Paper Question 4 by Dr. Margo Thorning, Senior Vice President and Chief Economist, American Council for Capital Formation,

Answer: Involving developing countries like China, India, Indonesia and Brazil is required to achieve meaningful progress in limiting the growth in global emissions. However, in climate policy discussions before, during and after the negotiations on the Kyoto Protocol, developing countries like China and India made it clear they would simply not participate in mandatory programs that would place a cap on their emissions that would be in direct conflict with their growing populations and need to improve their citizens' standard of living. The notion that the developing countries would join a US cap/trade program when they rejected mandatory obligations under the Kyoto Protocol program is simply unrealistic.

Recently China and India indicated that they are willing to participate in voluntary technology based efforts to improve their citizens' standard of living, while addressing ground-level pollution issues as well as climate concerns. The recently initiated Asia-Pacific Partnership on Clean Development and Climate is an example of this. Drawing on developing country willingness to participate in multi-national joint voluntary programs that focus on improving technology that addresses other issues like ground-level pollution and improved living standards – while also allowing progress on climate issues -- may be a much more productive approach than mandatory cap/trade programs.

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Margo Thorning, American Council for Capital Formation

Clarifying Question 4a:

- What metrics are most valuable for comparison of developed and developing country mitigation efforts to U.S. efforts?

Please begin your response HERE. (no page limit)

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Margo Thorning, American Council for Capital Formation

Clarifying Question 4b:

- What process should be used to evaluate the efforts of other nations and how frequently should such an evaluation take place?

Please begin your response HERE. (no page limit)

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Margo Thorning, American Council for Capital Formation

Clarifying Question 4c:

- Are there additional incentives that can be adopted to encourage developing country emission reductions?

Please begin your response HERE. (no page limit)

Center for Clean Air Policy

Submitter's Name/Affiliation: Center for Clean Air Policy
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Provide an executive summary of your response(s). ***Do not exceed the remainder of this page.***

Overall Trading System Design: We recommend for consideration use of a hybrid approach in which a downstream system for power plants and large industrial sources is combined with upstream caps on oil refiners, natural gas processing plants and fuel distribution companies. Such a system combines the political advantages of a downstream approach (for example, a downstream program is more familiar and it is easier to require reductions from large sources than from small ones) with fairly broad coverage via an upstream cap for small sources in the residential, commercial and transportation sectors. For details on this hybrid approach, please see, "An Upstream/Downstream Hybrid Approach to Greenhouse Gas Emissions Trading" located at http://www.ccap.org/publications_climate.htm#AIRLIEPUB .

Allowance Allocation: From a purely economic standpoint, the preferred allocation method is an auction in which revenues are recycled to lower taxes. This method minimizes the overall costs to the economy. However, an auction with revenue recycling is criticized by many in industry as requiring them to pay twice—once for the greenhouse gas mitigation or other compliance activities and once for the purchase of allowances. Also, use of all auction revenues to lower taxes removes a powerful opportunity to simultaneously advance the technologies needed to move to a less carbon-intensive economy, and later, to adapt to future climate conditions. Therefore, while we would encourage the use of an auction and tax rebates to account for a portion of the overall allocation, we believe that the development of winning legislation and effective climate strategy will include allocations to industry and consumers as well as a sizeable dedicated allocation for the advancement of climate-friendly technologies.

Linkages with Other Systems: Climate change is a global problem that requires a global solution. Linkages across systems are needed to encourage the most cost-effective control strategies. There is the potential for such linkages to benefit the US to the extent that lower cost opportunities are available elsewhere. Advantages to US industry from linkages may include greater liquidity and greater certainty in the availability of allowances at a prevailing international market price.

Maintaining Competitiveness: Finally, in response to concerns that a mandatory control program will place US industry at a competitive disadvantage to industries in developing countries while failing to achieve climate goals, we suggest use of an active approach in which the US works with developing countries to develop equivalent targets for major energy and heavy industry sectors (e.g., electricity, cement, steel, oil refining, pulp and paper, metals) using a sector-based approach (see www.ccap.org/international/Sector%20Proposal~4-pager.pdf for details on this concept). This approach establishes a process for setting sector targets that use consistent, bottom-up technology based assessments at the start to achieve consistent levels of effort for the industrial sector in developed and developing countries.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Center for Clean Air Policy

Who is regulated and where?

We recommend for consideration use of a hybrid approach in which a downstream system for power plants and large industrial sources is combined with upstream caps on oil refiners, natural gas processing plants and fuel distribution companies. Such a system combines the political advantages of a downstream approach (for example, a downstream program is more familiar and it is easier to require reductions from large sources than from small ones) with fairly broad coverage via an upstream cap for small sources in the residential, commercial and transportation sectors. For details on this hybrid approach, please see, "An Upstream/Downstream Hybrid Approach to Greenhouse Gas Emissions Trading" located at http://www.ccap.org/publications_climate.htm#AIRLIEPUB .

Question 1. Point of Regulation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Question 1a:

- Is the objective of building a fair, simple, and rational greenhouse gas program best served by an economy-wide approach, or by limiting the program to a few sectors of the economy?

A fair greenhouse gas program is best served by regulations that encourage greenhouse gas reductions from all sectors of the economy. In this way, the responsibility is spread across all contributors to climate change and there are maximum opportunities for encouraging innovation and identifying cost-effective solutions.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Question 1b:

- What is the most effective place in the chain of activities to regulate greenhouse gas emissions, both from the perspective of administrative simplicity and program effectiveness?

Considering just the issues of administrative simplicity and effectiveness (from the standpoint of maximizing coverage), the best choice would be to regulate greenhouse gas emissions upstream—at the refineries, oil importers, natural gas pipelines and processing plants, and coal mines and preparation plants. Despite these theoretical advantages, an upstream program has been critiqued as being too much like a tax on greenhouse gas emissions and for not encouraging downstream innovation as the point of regulation is distinct from the downstream location of the needed mitigation actions. Related concerns have also been raised about upstream caps effectively establishing quotas on fuel supplies.

We therefore recommend for consideration use of a hybrid approach in which a downstream system for power plants and large industrial sources is combined with upstream caps on oil refiners, natural gas processing plants and fuel distribution companies. Such a system combines the political advantages of a downstream approach (for example, a downstream program is more familiar and it is easier to require reductions from large sources than from small ones) with fairly broad coverage via an upstream cap for small sources in the residential, commercial and transportation sectors. For details on this hybrid approach, please see, "An Upstream/Downstream Hybrid Approach to Greenhouse Gas Emissions Trading" located at http://www.ccap.org/publications_climate.htm#AIRLIEPUB .

Question 2. Allocation
Submitter's Name/Affiliation: Center for Clean Air Policy

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

From a purely economic standpoint, the preferred allocation method is an auction in which revenues are recycled to lower taxes. This method minimizes the overall costs to the economy. However, an auction with revenue recycling is criticized by many in industry as requiring them to pay twice—once for the greenhouse gas mitigation or other compliance activities and once for the purchase of allowances. Also, use of all auction revenues to lower taxes removes a powerful opportunity to simultaneously advance the technologies needed to move to a less carbon-intensive economy, and later, to adapt to future climate conditions. Therefore, while we would encourage the use of an auction and tax rebates to account for a portion of the overall allocation, we believe that the development of winning legislation and effective climate strategy will include allocations to industry and consumers as well as a sizeable dedicated allocation for the advancement of climate-friendly technologies.

Question 2. Allocation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Questions 2a:

Technology R&D and Incentives

- What level of resources should be devoted to stimulating technology innovation and early deployment?
- What portion, if any, of the revenues from permits or the auction of allowances should be reserved for technology development? If some portion is reserved for this purpose, should that set-aside flow to the federal government with funds spent through the traditional appropriation process? Or should the funds be allocated directly to a non-profit research consortium, chartered by the federal government, which would then administer technology development and deployment projects? Or should there be some combination of these two options?
- What criteria should be used to determine how such funds are spent and which projects are chosen?
- What other mechanisms should be used to promote technology deployment? Options include tax credits, cost-sharing for demonstration projects, assistance to state energy programs, etc.

To have maximum effect, incentives for early technology deployment should go hand-in-hand with regulation. This helps avoid the "chicken and egg" problem of setting regulations when technical solutions are not available, and of limited incentives to develop technology in the absence of a regulatory driver. We estimate that for IGCC and carbon capture alone, an incentive on the order of \$8.2 billion is needed to encourage 17.5 GW of IGCC with carbon capture and sequestration by 2018, assuming half of this sequestration takes advantage of low cost enhanced oil recovery opportunities.[1] On an annualized basis, the total[2] value of required incentive payments (via direct allocation of allowances or revenues from allowance auctions) would amount to roughly \$1 to \$1.5 billion per year (\$1999). If similar innovations are to be had in other sectors (e.g., transportation, industrial/commercial/residential, agriculture/forestry), we expect the necessary level of technology incentives may need to be higher than what was proposed by the NCEP, though we have not analyzed the required payments for other sectors associated with specific levels of technology deployment at the national level.

[1] This estimate comes from modeling that was conducted as part of the Center for Clean Air Policy's multi-stakeholder Air Quality Dialogue on Multipollutant Control Approaches. 17.5 GW is equivalent to one-quarter of the existing small (less than 300 MW) and less efficient pulverized coal plants. This level was deemed reasonable by dialogue participants. Note also that the costs for IGCC+CCS incentives assume an underlying 3P program that is different from the final Clean Air Interstate Rule and Mercury Rule. The NOx and SO2 controls modeled may be slightly weaker and the mercury controls somewhat tougher.

[2] Some incentives for IGCC with carbon capture and sequestration were already approved through the Energy Bill. Therefore, these amounts probably overestimate the remaining incentive levels needed to encourage 17.5 GW of IGCC with carbon capture and sequestration.

Question 2. Allocation

Submitter's Name/Affiliation: Center for Clean Air Policy

The choice of whether allocations or funds should flow to the federal government or to a non-profit consortium is a political decision. Our preference would be whichever approach is most effective in getting the funds to the technology endpoints.

One mechanism for consideration is use of a "Technology Incentive Pool" in which a set amount of allowances is provided to early adopters of advanced carbon mitigation technology. The Technology Incentive Pool could be implemented using a reverse auction in which technology purveyors bid to win incentive dollars on the basis of expected GHG reductions per dollar. This ensures that emissions reductions are achieved at the lowest cost. Separate pots of money could be established for different industry sectors or subsectors and/or technology categories to ensure that deployment occurs broadly and using a wide range of promising technologies. To the extent possible, technologies should be defined broadly (e.g., measures that improve efficiency by at least 50 percent) to encourage innovation and avoid picking winners.

Question 2. Allocation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Questions 2b:

Adaptation Assistance

- What portion of the overall allowance pool should be dedicated to adaptation research or adaptation-related activities?
- How should these allowances or funds be administered?
- What is the appropriate division between federal vs. regional, state, and local initiatives?

While mitigation of greenhouse gas emissions will help reduce the effects of climate change, the effects of climate change will nonetheless be felt throughout the United States. Any comprehensive climate change program must include adaptation strategies.

At this stage, for most locations in the United States, it will be decades before the harmful effects of climate change will need to be mitigated. This leads to two interim conclusions. First, today the amount of funding required for adaptation is very small and may be limited in initial scope. Second, proper planning today can reduce or eliminate the need for future adaptation funding.

To address immediate issues, a very small share (likely to be less than 1 percent) of the allowance pool should be dedicated to adaptation research or strategies. The Senate might begin by commissioning reports on the impacts of climate change in the most vulnerable areas (such as Alaska which is already beginning to see impacts), and to study specific infrastructure vulnerabilities that could be mitigated through adaptation. The studies will gain both a better understanding of the magnitude and costs of the potential problems we will face. This information will then allow for more informed decision making on the prioritization of resources between mitigation and adaptation, or the split among federal vs. regional, state and local initiatives without a more complete understanding of the vulnerabilities.

Separate from allowance allocations, the Senate should consider putting in place a framework that would be applied to current infrastructure planning and funding that uses federal resources. Infrastructure decisions made today will likely be affected by the future adverse effects of climate change and it is appropriate to begin now to incorporate these future effects into planning decisions. For example, federal highway funds should require that permitting and/or environmental impact studies look at such factors as climate change. This may prevent, for example, a highway from being built in what is expected to be a new or expanded flood plain due to climate induced changes. Through careful planning and investment in "climate-proof" infrastructure, it may be possible to reduce or eliminate excessive expenditures for mitigation activities in the future.

Question 2. Allocation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Questions 2c:

Consumer Protections

- What portion of the overall allocation pool should be reserved to assist consumers?
- Should funds from the sale of permits or allowances be targeted primarily to low-income consumers, or should they be more widely distributed to benefit all consumers?

We suggest use of a trigger price such that allowances (either within or above the core allocation) are allocated to the benefit of the poor in the event that carbon prices exceed a particular level. Below this trigger price, no payments would be provided. Above this price, low income consumers would receive payments funded by the sale of permits or allowances to reimburse a portion of the increase in energy prices.

Question 2. Allocation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Questions 2d:

Set-Aside Programs

- What portion of the allocation pool should be reserved for the early reduction credit program and the offset pilot program?
- Are other set-aside programs needed?

A very small share of the allocation pool should be reserved for early reduction credits. While it is desirable to recognize early actors who legitimately undertook climate control measures that were additional to what they would have done business as usual, actions that were registered under the 1605(b) voluntary reporting program suffer from methodological difficulties that make it difficult to assess the validity of any particular GHG mitigating action. For example, project sponsors were allowed to select their own baselines, criteria were not established to ensure additionality, and third party verification was not required. Therefore, any allowances granted for these actions through a set aside program should be significantly discounted. Actions registered after the recent 1605(B) revisions still do not meet standards developed by other offset programs, so we expect there will still be a need for some discounting.

While it is possible to establish a set aside for offsets, a better approach may be to allow high quality offsets to be used by sources for compliance. If desired, limits could be established on the total share of emissions or compliance that can be met through offset purchases. Either way, the offset program should provide for a standardized set of emissions baseline protocols for a range of sectors as well as clear rules for determining additionality, permanence, etc. It should also establish a process for developing offsets from sectors that were not envisioned up-front.

In addition, we suggest for consideration the fundamental principle that all sectors should be required to contribute to the climate solution, whether they participate as capped sources or as offsets. The rationale for this is that climate change is such a large problem that all sectors should be asked to be part of the solution, even sectors that are designated as offsets. Implementing this principle could involve establishing a baseline that includes an independent commitment for a given sector, or requiring that for every ton of offset accepted by the set aside program, that another ton (or fraction) be retired for the climate.

Question 2. Allocation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Questions 2e:

Special considerations for fossil-fuel producers?

- Would some upstream fossil fuel producers be unable to pass the cost of purchasing permits or allowances through in fuel prices if they are the regulated entity?
- Is there a sufficient policy rationale for addressing these costs to justify the complexity of setting up and administering an allocation system for these entities?
- What other options exist to address the inability of fossil fuel producers to pass through these costs?

A February 22, 2002 study conducted by Charles River Associates for the Center for Clean Air Policy, "Who Wins and Loses under a Carbon Dioxide control Program" (see www.ccap.org/pdf/ccap_cra_report.pdf), predicts that the coal industry would lose 65 percent of its equity value[3] under an upstream auction and that other upstream energy industries (oil and gas extraction, refining, and gas distribution) would lose between 4 and 8 percent of their equity values. This study estimated that compensating shareholders of all energy industries (including downstream sectors) for these losses would on average require about 9 percent of total auctioned allowances.[4] However, the compensation amount would go up in the event that it was deemed desirable to cover losses to workers and communities.

[3] This is equivalent to shareholder value.

[4] This 9 percent figure assumes a cap at 7 percent below 1990 levels.

Question 2. Allocation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Questions 2f:

Allocations for downstream electric generators?

- Should electricity generators be included in the allocation if they are not regulated? (Clarification: We mean to ask if an electric generator should be included in the allocation if the greenhouse gas regulation occurs at a point of regulation that is upstream or downstream from the generator, but not the generator itself.)
- What portion of the total allocation should be granted to the electric power sector? Should it be based on the industry's share of greenhouse gas emissions or some other factor?
- Should generators in competitive and cost-of-service markets be treated differently under an allocation scheme?
- How should permits or allowances be distributed within the electric sector? Should it be based on historic emissions? Electricity output? Heat input?

Whether or not electricity generators are included in the allocation if they are not directly regulated is a political decision as it won't affect program efficiency. According to a February 22, 2002 study conducted by Charles River Associates for the Center for Clean Air Policy, "Who Wins and Loses under a Carbon Dioxide control Program" (see www.ccap.org/pdf/ccap_cra_report.pdf), the power sector is slated to lose about 4 percent of its equity value under an upstream auction. Therefore, it appears there would be a legitimate reason to provide a small amount of compensation, through allocations or otherwise. One suggestion would be to provide allowances or a share of funds raised at auction to the electricity sector to be used for dedicated investments in low/zero-emitting technologies and energy efficiency.

Generators in competitive and cost-of-service markets should be treated differently. Cost-of-service markets generally allow electric generators to pass their control costs to consumers while plants in competitive markets generally cannot. Equal treatment of regulated and unregulated plants is needed to help level the playing field and ensure that all plants are encouraged to be more efficient. A Technology Incentive Pool or other technology funds could be directed towards companies in competitive markets to help address the discrepancy.

Industry representatives have mixed views on the choice of allocation method. For example, those with older coal-based fleets prefer historic input-based allocations while those with newer gas-based fleets prefer output based approaches. It is unlikely that any one approach to giving away allowances will achieve political consensus. Therefore, we propose the consideration of hybrid approaches, for example:

- A phased approach that moves from the status quo (recent historic emissions) to slowly recognizing ongoing changes in the generation mix through periodically (say, every ten years) updating growing portions of the allowances given to the electricity sector based on recent historic electricity output.

Question 2. Allocation
Submitter's Name/Affiliation: Center for Clean Air Policy

This type of approach would provide for a gradual transition that acknowledges the current reliance on coal-based generation but increasingly recognizes the advantages of generating power from lower-emitting resources.

Question 2. Allocation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Questions 2g:

Allocations for energy-intensive industries?

- Is there a sufficient policy rationale to have an allocation to selected energy-intensive industries? What industries should be included in the allocation?
- What portion of the overall allocation framework should be reserved for these industries?
- What are the appropriate metrics for determining allocations across different industries?

A February 22, 2002 study conducted by Charles River Associates for the Center for Clean Air Policy, "Who Wins and Loses under a Carbon Dioxide control Program" (see www.ccap.org/pdf/ccap_cra_report.pdf), predicts little change in equity value for some heavy industries. For example, the iron and steel industry would not gain or lose equity value.[5] Therefore, there does not appear to be a need to compensate "losing" heavy industry sectors from the standpoint of keeping shareholders whole. However, there could be other justifications to provide allowances for such sectors (e.g., labor, communities, etc.)

[5] This is equivalent to shareholder value.

Question 3. International Linkage
Submitter's Name/Affiliation: Center for Clean Air Policy

Should a U.S. system be designed to eventually allow for trading with other greenhouse gas cap-and-trade systems being put in place around the world, such as the Canadian Large Final Emitter system or the European Union emissions trading system?

Climate change is a global problem that requires a global solution. Linkages across systems are needed to encourage the most cost-effective control strategies. There is the potential for such linkages to benefit the US to the extent that lower cost opportunities are available elsewhere. Advantages to US industry from linkages may include greater liquidity and greater certainty in the availability of allowances at a prevailing international market price.

Question 3. International Linkage
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Question 3a:

- Do the potential benefits of leaving the door open to linkage outweigh the potential difficulties?

Linking of trading systems will be critical in the long-run for achieving deeper mitigation targets. However, there are important benefits even in the near- and medium-terms, including market liquidity, certainty in the availability of allowances, and the ability to take advantage of lower cost mitigation opportunities in developing countries.

Question 3. International Linkage
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Question 3b:

- If linkage is desirable, what would be the process for deciding whether and how to link to systems in other countries?

Due to restrictions within the Kyoto Protocol, it will not be possible for the US to fully link with the European Emissions Trading System or to other Kyoto country systems through 2012. US allowances would not have value in these systems, though purchases could be possible. Early linkages would be possible with Australia.

Going forward (post-2012), the key question for successful linkages that maintain the integrity of a US program is comparable stringency. This means that targets are set to achieve real and "equivalent effort" reductions from projected business-as-usual levels, that programs have comparable monitoring, reporting and verification requirements as well as comparable rules for data quality and mandatory reporting.

A review of another program could lead to a definitive yes/no decision on whether or not that system should be a trading partner. Alternatively, a program review could result in an appropriate discount factor (or multiplier). For example, allowances from a trading system deemed to be 75 percent as good as our own would be valued at 75 percent of a full allowance. In this way, it would be possible to maximize liquidity while adjusting for real differences in program quality.

Question 3. International Linkage
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Question 3c:

- What sort of institutions or coordination would be required between linked systems?

All that is required is recognition of allowances from other systems. Ideally, the trading partner would reciprocate and recognize allowances from the US.

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Center for Clean Air Policy

If a key element of the proposed U.S. system is to "encourage comparable action by other nations that are major trading partners and key contributors to global emissions," should the design concepts in the NCEP plan (i.e., to take some action and then make further steps contingent on a review of what these other nations do) be part of a mandatory market-based program? If so, how?

In response to concerns that a mandatory control program will place US industry at a competitive disadvantage to industries in developing countries while failing to achieve climate goals, we suggest use of an active approach in which the US works with developing countries to develop equivalent targets for major energy and heavy industry sectors (e.g., electricity, cement, steel, oil refining, pulp and paper, metals) using a sector-based approach (see www.ccap.org/international/Sector%20Proposal~4-pager.pdf for details on this concept). This approach establishes a process for setting sector targets that use consistent, bottom-up technology based assessments at the start to achieve consistent levels of effort for the industrial sector in developed and developing countries.

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Question 4a:

- What metrics are most valuable for comparison of developed and developing country mitigation efforts to U.S. efforts?

Some important metrics for comparison of developed and developing country mitigation efforts with US efforts include 1) the price of carbon allowances, and 2) the level of existing regulation. If carbon allowances in another country are significantly less expensive than those in the US, it may indicate the program is significantly weaker. However, it could also mean there is greater opportunity for cost-effective GHG mitigation measures. Alternatively, if existing regulation in another country is much weaker, this could mean that they should be required to undertake extra effort to make up for past deficiencies.

Another concept worth exploring in understanding comparability is that of sector-based approaches for developing countries. Under this approach, each country would adopt a target that assumes equivalent actions or technologies in each of a number of key industry sectors (e.g., electricity, cement, steel, oil refining, pulp and paper, metals). Such an approach helps to level the playing field for internationally competitive industry sectors. Key metrics include GHG intensities for different industry sectors. Interestingly, contrary to what one might guess, many developing countries have lower GHG intensities than the US for certain industry sectors. As an example, the graph below shows GHG intensities for the cement sector in various countries.

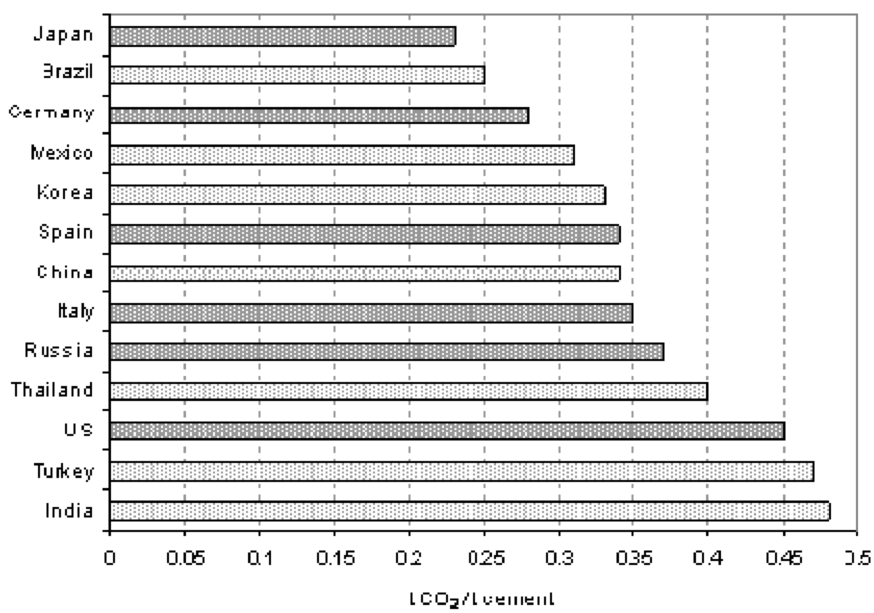

Figure 7. CO_2 emissions intensity of cement production in various countries. Dark and light bars represent emissions intensities in Annex I and non-Annex I countries, respectively. Note that there is no obvious distinction in emissions intensity between these two groups of countries (Hendriks et al., 1999; Price et al., 1999).

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Question 4b:

- What process should be used to evaluate the efforts of other nations and how frequently should such an evaluation take place?

Please begin your response HERE. (no page limit)

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Center for Clean Air Policy

Clarifying Question 4c:

- Are there additional incentives that can be adopted to encourage developing country emission reductions?

Consider joint development of targets covering emissions from major energy and heavy emitting industrial sectors using a sector-based approach. This could mean working together with developing countries to identify technology solutions or emissions benchmarks applicable to each of several large industry sectors and applying those rules to the industry sector in each country to determine equivalent targets. In our paper, "The Sectoral Pledge Approach," (found at www.ccap.org/international/Sector%20Proposal~4-pager.pdf), we suggest two ways to encourage developing country participation, including the following:

- Technology Finance and Assistance Program – This program would support 1) specific commitments for deployment of advanced technologies, 2) the development of small and medium-sized enterprises for assistance with technology implementation, 3) capacity building and 4) support for pilot and demonstration projects. Funds from the TFAP could also be used to leverage private sector investment by writing down cost and mitigating risk to levels that would ensure competitive returns for private investors.
- The ability to receive emissions reduction credits if they exceed the target.

In addition, reliance on a process that uses country-specific data for developing national targets can help build confidence that the resulting commitments will be achievable.

Congressional Budget Office

Submitter’s Name/Affiliation: Congressional Budget Office
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If policymakers decide to limit emissions of carbon dioxide, the primary greenhouse gas, through a cap-and-trade program, they face a choice about where in the production process to implement the regulation. An “upstream” cap would offer two significant advantages and one potential disadvantage over a “downstream” cap:

- An upstream cap would create economywide incentives for households and businesses to reduce their consumption of carbon-intensive goods and services. As a result, it would reduce emissions at a lower cost than if the cap (and resulting incentives for reduction) had been restricted to one downstream sector, such as the electricity sector.
- The costs and complexity of implementing an upstream cap, which would require regulating a limited number of suppliers of fossil fuels, would be significantly less than that of a comprehensive downstream system, which could potentially entail regulating millions of emitters.
- An upstream cap may not provide an incentive to adopt post-combustion technologies that facilitate the capture and sequestration of carbon emissions. Such an incentive could be created by a downstream system that determined allowance requirements on the basis of monitored emissions. An upstream system could provide incentives for sequestration if firms were allowed to meet their allowance requirements by paying for downstream sequestration.

Capping greenhouse gas emissions would impose costs throughout the economy: entities would pay for those costs in the form of higher prices, reduced profits, and lower wages. At the same time, the pool of allowances would have substantial value to those who hold them. Policymakers would need to decide whether to sell the allowances to regulated firms, to give them away, or to implement a combination of the two.

Selling allowances rather than giving them away would not increase the overall economic costs of the cap-and-trade program but would provide an opportunity to use the allowance revenue to reduce other economic distortions. For example, policymakers could use the new source of revenue to reduce existing taxes that tend to slow economic growth (that is, taxes on productive inputs such as capital and labor); to decrease the federal debt; or to fund other government objectives (which otherwise would rely on taxes on productive inputs). As a result, the level of economic activity could be higher if policymakers sold some of the allowances than if they allocated them all at no cost.

Alternatively, policymakers could give some allowances (at no cost) to select firms or individuals to offset the costs that they would incur under the new regulations. Decisions about compensation are complicated by several factors:

- Determining who bears the costs of the cap is difficult. Regardless of whether allowances are sold or given away, the costs of the cap are distributed throughout the economy based on underlying supply and demand conditions.
- Decisions about allocating allowances can increase the overall costs of achieving the cap if they are linked to decisions that influence current emissions. Basing decisions about allowance allocations on historic amounts of production, consumption, or emissions would avoid that problem.
- The costs of the cap would extend beyond firms and consumers to the federal government. Provided that policymakers wanted the government to at least break even under the cap, they would need to reserve a share of the allowances to offset the government’s program-induced costs.
- Workers in carbon-intensive industries, such as coal, cement, or aluminum, would be adversely affected if the cap reduced production of those goods. Allocating allowances (at no cost) to firms in affected industries would be likely to benefit the firms’ shareholders but not the firms’ workers.

Finally, the inclusion of a safety valve in the cap-and-trade program could help keep the economic costs of the program in line with the expected benefits of reducing emissions.

Question 1. Point of Regulation
Submitter's Name/Affiliation: (Congressional Budget Office)

Who is regulated and where?

Clarifying Question 1a:

- Is the objective of building a fair, simple, and rational greenhouse gas program best served by an economy-wide approach, or by limiting the program to a few sectors of the economy?
-

Clarifying Question 1b:

- What is the most effective place in the chain of activities to regulate greenhouse gas emissions, both from the perspective of administrative simplicity and program effectiveness?

The following response addresses both of these clarifying questions simultaneously.

Deciding where in the production process it would be most effective to place the cap would depend on the particular greenhouse gas in question. The following discussion applies to carbon dioxide, the primary greenhouse gas.[2] An "upstream cap" would limit the amount of fossil fuels introduced into the economy; in contrast, a "downstream cap" would place the cap closer to the point where those fuels are combusted and emissions are released. As discussed below, an upstream cap would be expected to be more cost-effective—that is, it would be more likely to achieve any given amount of emission reductions at a lower cost than a downstream cap.[3]

The advantages offered by an upstream cap are twofold. First, it would entail regulating a relatively small number of entities. Second, it would create economywide incentives to reduce the amount of fossil fuel consumed. Thus, it would provide an incentive to cut carbon emissions where they can be reduced most cheaply. (Providing incentives to reduce fossil fuels is equivalent to providing incentives to reduce carbon emissions with one exception—it does not provide an incentive to adopt post-combustion technologies that facilitate the capture of carbon emissions for sequestration. That is discussed in more detail below.)

The economywide incentives for reducing carbon emissions under an upstream design stem from the price increases that would result from limiting the production of fossil fuels. Carbon is a component of fossil fuels. It enters the economy when those fuels are imported or produced

2. In 2004, carbon dioxide from energy combustion accounted for 82.4 percent of greenhouse gas emissions in the United States (measured in carbon dioxide equivalents). See the Energy Information Administration's annual reports on U.S. greenhouse gas emissions at www.eia.doe.gov/oiaf/1605/1605aold.html.

3. For a more detailed discussion of the pros and cons of an upstream versus a downstream design, see Congressional Budget Office, *An Evaluation of Cap-and-Trade Programs for Reducing U.S. Carbon Emissions* (June 2001).

domestically and is emitted when they are burned. Under an upstream program, the producers and importers of fossil fuels would be required to hold allowances based on the carbon content of their fuel—that is, the carbon emitted when the fuel is combusted.[4] An upstream cap on carbon emissions would limit production of carbon-based fossil fuels and would cause the price of those fuels to rise—with price increases reflecting each fuel's allowance requirements and, hence, its carbon content.

The increases in fossil fuel prices that would result from the upstream cap would raise firms' and households' costs, encouraging them to decrease their consumption of fossil fuels and energy-intensive goods and services. (For example, households might drive less, and utilities might replace coal with lower-carbon-emitting fuels, such as natural gas or renewable sources of energy.) As a result, households and businesses throughout the economy would have an incentive to reduce all forms of carbon consumption and thus carbon emissions. That equal incentive—throughout the entire economy—would help limit the costs associated with achieving any given level of emission reductions. Further, the higher fossil fuel prices that would result from the cap would provide an incentive for firms to conduct research that could lead to innovations that would reduce fossil fuel use—for example, improvements in energy efficiency and renewable energy sources. Because the price increases would be economywide under an upstream cap-and-trade program, the incentives for innovation would be economywide as well, covering transportation, electricity generation, and industrial processes. As such, an upstream cap-and-trade program could encourage research and development on a wide range of carbon-reducing technologies.

An attempt to achieve economywide incentives for reducing carbon emissions under a downstream cap-and-trade program would probably entail much higher implementation costs. The costs of implementing an upstream program are held down because there is a limited number of producers and importers of fossil fuels and because their allowance requirements could be determined on the basis of information about the amount and type of fuel that they sold in the United States.[5] In contrast, a comprehensive downstream system could entail regulating many more entities. The further downstream the allowance requirement is placed, the larger the number of entities that would need to be regulated. Ultimately, carbon is emitted by roughly 380,000 industrial establishments, millions of commercial buildings, and hundreds of millions of homes and automobiles.[6]

Although an economywide approach to reducing emissions would probably be more cost-effective, the administrative costs of implementing a downstream cap-and-trade program could be reduced if the cap covered only a limited number of sectors. Roughly 40 percent of carbon

4. To avoid making the cap place U.S. exports of fossil fuels at a disadvantage, fossil fuels that were exported could be exempt from the cap. Regulating importers and exempting exporters would have the effect of restricting the emissions associated with U.S. consumption (not production) of fossil fuels.

5. The Center for Clean Air Policy estimated that an upstream program would require less than 2,000 entities to hold allowances. See Center for Clean Air Policy, *U.S. Carbon Emissions Trading: Description of an Upstream Approach* (Washington, D.C.: Center for Clean Air Policy, March 1988), p. 7.

6. Ibid., p. 5.

dioxide emissions stem from the combustion of coal and natural gas to generate electricity; 32 percent result from the combustion of transportation fuels, such as gasoline and diesel; and the remaining 28 percent stem from the combustion of coal, oil, or natural gas directly by the residential, commercial, or industrial sectors.[7]

Some legislative proposals would have limited a carbon cap to the electricity sector. Limiting the cap to the electricity sector would greatly reduce implementation costs relative to a comprehensive downstream cap; however, it would have several disadvantages relative to an upstream cap. First, a downstream system that was limited to electricity generators would confine incentives for cutting carbon emissions—and for innovation—to that sector, even if potentially lower-cost reductions could have been obtained from sources outside that sector. For example, such a cap would not encourage emission reductions that stem from transportation or from fossil fuel uses in industrial and commercial sectors not associated with their purchase of electricity from covered generators. Second, a downstream cap would offer less certainty than an upstream cap that any desired reduction in U.S. emissions would be achieved. Because the cap would restrict emissions in only one sector, emissions in other sectors could continue to grow. Further, to the extent that electricity generation could shift among establishments to avoid the cap, the system could create leakage. For example, if the program was designed to cover emitters above a certain size (in order to limit the number of regulated entities and to hold down the administrative costs of the program), more electricity generation could shift to facilities that were smaller than the cutoff size.

Although moving the allowance requirement downstream is likely to either increase the costs of implementing the program (if a downstream program was comprehensive) or decrease the cost-effectiveness of the emission reductions that were achieved (if the downstream program was limited to specific sectors), it could offer one advantage relative to an upstream design: it could provide incentives for the use of post-combustion technologies designed to capture carbon emissions for sequestration (that is, long-term storage). That incentive would be achieved if the downstream system regulated actual emissions from sources rather than approximating their emissions on the basis of the fuels that they consume. For example, a cap on emissions from the electricity sector would provide generators with an incentive to install technologies that would scrub emissions from their smokestacks. Those emissions could then be sequestered. (For example, researchers are exploring the feasibility of sequestering carbon emissions in abandoned oil wells and in the ocean.) Alternatively, upstream cap-and-trade programs could be designed to provide incentives for such carbon capture and sequestration if upstream firms were allowed to meet some fraction of their allowance requirement by paying for the capture and sequestration of carbon. (As discussed under clarifying question 2d, those provisions could allow for biological sequestration as well.)

7. See www.eia.doe.gov/emeu/aer/txt/ptb1202.html.

Question 2. Allocation
Submitter's Name/Affiliation: (Congressional Budget Office)

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

A general discussion of each of these three questions is provided here. The observations made here apply generally to all of the clarifying questions (about allocations for specific purposes) that follow. Only details that pertain to particular clarifying questions are added under the clarifying questions that begin with 2a: Technology R&D and Incentives.

> *Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost?*

Restricting carbon emissions through a cap-and-trade program would probably be costly. As a result, discussions about such a program often include a consideration of whether entities that would bear a particularly large share of that cost would be compensated. (When examining the pros and cons of providing compensation, CBO assumes that decisions about the stringency of the cap would be made independently of decisions about compensation—that is, providing compensation would not be linked to a more stringent cap.) One method of compensating adversely affected entities would be to give them allowances at no cost. Unfortunately, identifying which entities are likely to bear the costs of the cap is difficult. Households, firms, nonprofit organizations, and government agencies all contribute to emissions of carbon dioxide and other greenhouse gases, and all would bear some share of the costs associated with restricting emissions.

Knowing where the cap is placed—that is, which firms would actually be required to hold allowances—provides little insight into who would actually bear the costs of the cap. That is because the costs of the cap do not stick to the point where it is placed; rather, the actual costs of restricting emissions are distributed throughout the entire economy. The extent to which the costs of the cap would be passed forward on to the ultimate consumers of goods and services (such as households and businesses that consume gasoline and electricity) or backward on to fossil fuel suppliers (such as coal producers and oil importers) would depend on the underlying supply and demand conditions for those products. In sum, decisions about which entities might receive compensation are complicated by the difficult task of determining where the actual costs of the cap would land. Decisions about compensation are unrelated to the decision about where the cap is actually placed because the distribution of the costs of the cap does not depend on the latter decision.

How would allocating allowances at no cost provide compensation? Because a cap-and-trade program would limit the quantity of carbon emissions that are allowed, the right to emit carbon (that is, the allowances) would be valuable. Depending on how stringent the cap is (and thus how valuable the allowances are), that value could be quite large.[8] Policymakers could give entities

8. For example, U.S. entities released rough 7 billion metric tons of greenhouse gases (measured in carbon dioxide equivalents) in 2004. Valued at $7 per ton (the safety-valve price used in the National

(for example, households, electric utilities, or coal producers) a share of the allowances to compensate them for the higher costs that they would incur as a result of the cap. Those entities could sell the allowances (to the firms that would be required to hold them) or use them to meet their own allowance requirement (if they are regulated).

Although providing allowances at no cost could compensate some entities, the value of the allowances is going to fall short of the costs that all affected entities combined incur as a result of the cap.[9] As such, policymakers would not be able to offset all firms, households, workers, nonprofits, and government agencies for the costs that they would incur. A decision to provide more compensation to some set of entities would inevitably reduce the compensation that could be offered to others.

Compensation could offset the initial costs of the cap for some entities, but it would not alter the initial distribution of the costs of the cap throughout the economy—that is, it would not alter the ultimate price changes that would result from the cap.[10] For example, providing allowances at no cost to coal producers would not lead to lower coal prices. Thus, compensating coal producers would not protect coal-fired electricity producers, or their customers, from the higher prices that they would be likely to face as a result of the cap. Because compensating entities that are required to hold allowances would probably not affect the price increases that would result from the cap, decisions about compensation would not alter the effect that the policy might have on the competitiveness of U.S. goods.

Difficulties in identifying who actually bears the costs of the cap mean that the government could unintentionally undercompensate or overcompensate various entities. For example, the distributional effects of a cap-and-trade program on electricity producers and consumers would depend on a variety of factors, including the degree of competition in the electricity market, the method of allowance allocation (discussed below), and the mix of generation assets (for example, coal, natural gas, nuclear, and hydro). Effects on an individual utility will differ from effects on the electricity sector as a whole depending on whether it sells power in a regulated or competitive power region, its particular mix of generation assets, and whether the individual entity was in existence when the policy went into effect.[11] Some utilities would be better off, and some would be worse off. Because it is difficult to determine the costs that any given utility would actually bear as a result of the cap, it is also difficult to determine the degree of compensation required to offset those costs, and hence, overcompensation is a possibility.

Commission on Energy Policy report *Ending the Energy Stalemate: A Bipartisan Strategy for Meeting America's Energy Challenges*), the value of those emissions would be $49 billion.

9. The costs of the policy would include the costs of the allowances themselves (equivalent to the allowance value) and the substitution costs—that is, the costs that entities would bear from reducing their consumption of fossil fuels.

10. Some exceptions to this are if allowances are granted as a function of current production or if allowances are given to utilities whose electricity prices are set by regulators. Those exceptions are discussed in more detail in the following sections.

11. For a discussion of those factors, see Dallas Burtraw and others, "The Effect on Asset Values of the Allocation of Carbon Dioxide Emission Allowances," *The Electricity Journal*, vol. 15., no. 5 (Washington, D.C.: Resources for the Future, March 2002).

Question 2. Allocation
Submitter's Name/Affiliation: (Congressional Budget Office)

When examining who actually bears the costs of the cap and considering the possibility of providing compensation, policymakers could consider the costs that the cap would impose on the government. If policymakers wanted the government to at least break even as a result of the cap-and-trade program, they would need to reserve a share of the allowances to offset the costs that the cap itself could impose on the government.[12] Those potential costs stem from several sources. First, governments are consumers of energy and energy-related services.[13] As such, they would bear a share of the costs of a cap-and-trade program that led to higher energy prices. Second, to the extent that the policy reduced economic activity (for example, the gross domestic product), government tax receipts would be reduced.[14] Third, government expenditures for transfer payments linked to price indexes (such as Social Security payments) would increase as a result of policy-induced price increases.

Should allowances by distributed by means of an auction?

As an alternative to distributing allowances without cost, policymakers could sell some, or all, of the allowances. Doing so would provide policymakers with a new source of revenue that could be used to reduce reliance on existing sources of revenue that tend to reduce economic activity.[15]

Most sources of government revenue create unwanted effects—that is, they discourage productive activity. For example, taxes on labor, capital, or income (a combination of the returns to labor and capital) tend to reduce incentives to work and to invest.[16] Selling the allowances would provide a new source of revenue that could be used for a variety of purposes, including reducing existing taxes on productive inputs (such as capital and labor), decreasing the federal debt, or funding other government objectives (which otherwise would rely on taxes on productive inputs).

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12. This discussion does not include the costs of actually implementing the cap-and-trade program.

13. The government is estimated to have consumed roughly 13 percent of carbon consumed in the United States in 1998. See Congressional Budget Office, *Who Gains and Who Pays Under Carbon-Allowance Trading? The Distributional Effects of Alternative Policy Designs* (June 2000), p. 11.

14. In contrast, to the extent that the allowance distribution led to increases in shareholders profits, a fraction of that increase would be received by federal, state, and local governments through collections in taxes on profits. For a discussion of the distributional effects that different allocation decisions would have, see Congressional Budget Office, *Who Gains and Who Pays Under Carbon-Allowance Trading?* and Terry M. Dinan and Diane Lim Rogers, "Distributional Effects of Carbon Allowance Trading: How Government Decisions Determine Winners and Losers," *National Tax Journal*, vol. 55, no. 2 (June 2002), p. 206.

15. Higher energy prices created by the cap would tend to slow economic growth as well. However, those price increases would occur regardless of whether the government sold the allowances or gave them away.

16. Higher prices created by a cap on emissions would reduce real income from working and investing and, thus, the incentive to do so. Such reductions in inputs to production would exacerbate the discouraging effect that existing taxes on labor and capital already have on productive activity. The exacerbation of existing tax distortions—called the tax-interaction effect—is difficult to measure but could be significant. However, the magnitude of the tax-interaction effect is likely to be the same whether allowances are sold or given away.

Thus, although selling allowances (as opposed to giving them away) would not have a direct influence on the costs of the cap, it would create an opportunity for policymakers to use the allowance value to reduce costs associated with unrelated spending or taxation programs.[17] The ultimate economic impact of selling allowances would depend on how policymakers used the allowance revenue. If policymakers gave the revenue back to regulated entities in a lump-sum fashion (not related to their use of capital or labor or their current level of production), the overall economic effect would be equivalent to a program in which they gave allowances to producers at no cost.

Even if the initial allowances (corresponding to the amount of emissions allowed under the cap) were allocated at no cost, the inclusion of a "safety valve" in a cap-and-trade program could result in the government selling additional allowances. The safety valve would establish an upper limit on the price of allowances. If the price of allowances rose to the safety-valve price, the government would sell as many allowances as was necessary to maintain that price. The amount of allowances sold under such a program would depend on the difference between the stringency of the cap and the safety-valve price. A stringent cap with a low safety-valve price could cause regulated entities to buy a substantial number of allowances.

If allowances are allocated, what is the criteria for and method of such allocation?

Two alternative methods of allocating allowances to firms are "output-based allocations," which link allocations to current production decisions, and "grandfathering," which bases allocations on historic emissions or production decisions. In general, analysts find that grandfathering would result in lower costs than output-based allocations. That is because output-based allocations distort production decisions in ways that increase the costs of obtaining a given level of emission reductions. This issue is discussed in more detail in clarifying question 2f.

17. For a discussion of the distributional implications of alternative allocation schemes, see Congressional Budget Office, *An Evaluation of Cap-and-Trade Programs for Reducing U.S. Carbon Emissions*.

Question 2. Allocation
Submitter's Name/Affiliation: (Congressional Budget Office)

Clarifying Questions 2a:

Technology R&D and Incentives

- What level of resources should be devoted to stimulating technology innovation and early deployment?
- What portion, if any, of the revenues from permits or the auction of allowances should be reserved for technology development? If some portion is reserved for this purpose, should that set-aside flow to the federal government with funds spent through the traditional appropriation process? Or should the funds be allocated directly to a non-profit research consortium, chartered by the federal government, which would then administer technology development and deployment projects? Or should there be some combination of these two options?
- What criteria should be used to determine how such funds are spent and which projects are chosen?
- What other mechanisms should be used to promote technology deployment? Options include tax credits, cost-sharing for demonstration projects, assistance to state energy programs, etc.

Technological advances could play an important role in reducing greenhouse gases at an affordable cost. A cap-and-trade program would provide incentives for firms to invest in developing new technologies; however, firms may not be able to reap the full benefits from those investments. As a result, firms' investments may fall short of the amount that would occur if all of the resulting benefits were taken into account. That shortfall may provide a justification for federal subsidies for R&D.

A cap-and-trade program would place an implicit price on carbon emissions, raising the costs of producing and consuming goods that generate those emissions. The higher prices created by those caps make it profitable for firms to develop technologies that could reduce the costs of cutting carbon emissions.[18] Those innovations could include improvements in energy efficiency or improvements in alternative energy technologies, such as solar, wind, or hydrogen. (Incentives for sequestering carbon would be created only if firms were allowed to meet their allowance requirement by engaging in sequestration activities.) Thus, a cap-and-trade program is appropriately viewed as stimulating private R&D on carbon-reducing technologies.

The magnitude of the incentives for R&D would depend on the stringency of the cap over time. A cap that was implemented for a short period of time would create less incentive for investment

18. In the absence of an explicit incentive to reduce carbon emissions, firms' incentives to reduce fossil fuel consumption (and associated carbon emissions) would stem from other market forces, such as the rising price of oil due to underlying conditions in supply and demand. Firms' investments in energy efficiency or alternative energy technologies, however, would fall short of the amount that would occur if they had an incentive to take the benefits of reducing carbon emissions into account.

in the development of new technologies than one that was expected to persist well into the future. In addition, the more stringent the initial cap was, or future caps were expected to be, the greater would be the incentives for R&D. Because decisions about investing in developing new technologies depend primarily on the future market for those technologies (when the R&D investments would bear fruit), expectations about future caps are of primary importance.

In general, research and development for all technologies (including carbon-reducing technologies) create "spillover benefits"— benefits that society as a whole would receive as a result of a firm's R&D effort but that the firm would be unlikely to capture in the form of higher profits. For example, the development of a new technology may result in general knowledge that is useful in many ways but is not directly covered by a patent. Similarly, one innovation may inspire subsequent innovations that are not tied closely enough to the initial innovation that they are covered by the patent. As a result of those spillover benefits, the profit motive may provide firms with too little incentive to invest in R&D. Existing general tax credits for R&D expenses and current funding of low-carbon energy sources, such as solar, nuclear, and wind, provide some additional incentives to at least partially account for those spillover benefits.

Supplementing private R&D efforts with federal funds would involve both costs and benefits. It would be efficient to the extent that the amount of private R&D stimulated by a cap-and-trade program would fall short of the amount that would occur if all benefits were taken into account. The ultimate efficiency of federal funding would, in turn, depend on the design of the federal funding initiatives (such as investment tax credits, targeted funding of specific technologies, or the offering of federal prizes for technological breakthroughs). The potential costs of federal R&D efforts include the cost of raising funds, the cost of efforts that are ultimately unsuccessful, and the extent to which federally funded R&D on carbon-reducing investments would crowd out other forms of R&D. Thus, it is possible to invest either too much or too little in federal R&D.

The existence of spillover benefits creates an economic rationale for subsidizing R&D on carbon-reducing technologies. However, there is no economic reason to link decisions about funding R&D to the revenues that might be generated by selling allowances under a cap-and-trade program. As described in the general discussion above regarding allocation decisions, the revenue from selling allowances could be used for a variety of different purposes that would have different overall effects on the economy. Likewise, decisions about funding R&D for carbon-reducing technologies could be considered on the basis of their own merit.

Question 2. Allocation
Submitter's Name/Affiliation: (Congressional Budget Office)

Clarifying Questions 2b:

Adaptation Assistance

- What portion of the overall allowance pool should be dedicated to adaptation research or adaptation-related activities?
- How should these allowances or funds be administered?
- What is the appropriate division between federal vs. regional, state, and local initiatives?

In light of the potential for future changes in climate, even if emissions were severely restricted, adaptation could play an important role in any effective climate strategy.[19] The appropriate funding for adaptation could be considered on its own merits—there is no economic reason to link it to the existence of a cap-and-trade program, to link it to the value of allowances created by a cap-and-trade program, or to fund it out of allowance revenues.

19. See Congressional Budget Office, *Uncertainty in Analyzing Climate Change: Policy Implications* (January 2005), p. 36.

Question 2. Allocation
Submitter's Name/Affiliation: (Congressional Budget Office)

Clarifying Questions 2c:

Consumer Protections

- What portion of the overall allocation pool should be reserved to assist consumers?
- Should funds from the sale of permits or allowances be targeted primarily to low-income consumers, or should they be more widely distributed to benefit all consumers?

A cap-and-trade program is likely to result in higher prices for energy and energy-intensive goods and services as the costs of the carbon restriction are passed on to the ultimate consumers of the products whose consumption results in carbon emissions. Those higher prices play an important role in inducing the behavioral changes that would ultimately reduce emissions, such as using more energy-efficient appliances and purchasing more fuel-efficient cars. At the same time, those higher prices will impose financial costs on consumers. The costs that individual consumers would bear would depend on the amount, and the mix, of goods that they buy. In general, higher-income households would bear more costs (measured in dollar amounts) simply because they consume more goods. Measured as a share of household income, however, the higher prices would impose a larger burden on lower-income households because lower-income households tend to consume a larger proportion of their income.[20]

20. See Congressional Budget Office, *Who Gains and Who Pays Under Carbon-Allowance Trading?*, p. 21, table 4.

Question 2. Allocation
Submitter's Name/Affiliation: (Congressional Budget Office)

Clarifying Questions 2d:

Set-Aside Programs

- What portion of the allocation pool should be reserved for the early reduction credit program and the offset pilot program?
- Are other set-aside programs needed?

Early Reduction Credits:

A program for reporting voluntary reductions in greenhouse gas emissions has been in effect since 1994. Over 2.5 billion metric tons of emission reductions (measured in carbon dioxide equivalent tons) have been reported under that program in the 1994-2004 time period.[21] The extent to which firms would benefit from those early reductions would depend, in part, on whether allowances were sold. If allowances were sold, early reducers would receive some benefit from their actions because those reductions would decrease the number of allowances that they would need to purchase once the cap was in effect.

If allowances were distributed without cost, then the extent to which firms would benefit from early reductions would depend on whether policymakers allowed them to receive credits for their early reductions (or for a fraction of them). Issuing credits for early reductions would shift costs from companies that engaged in early reductions to ones that did not (provided that the overall cap was unaffected by the amount of early reductions made). Free allowances to early reducers would decrease the number of allowances that could be distributed to other firms. As a result, firms that did not make early reductions would bear a larger share of the costs of meeting the limit on emissions once the cap was in place.

The shift in the cost burden away from firms that received early-reduction credits could be problematic if those credits were earned for reductions that the firms would have found it profitable to make anyway, regardless of regulatory incentives. In that case, companies would receive credit for such reductions, even though they would not have decreased emissions relative to the level that would have occurred without an early-reduction program.[22]

Offsets:

Policymakers would need to decide whether to build incentives for sequestration into a cap-and-trade program. A trading program that calculated allowance requirements on the basis of the carbon content of the fossil fuel used, produced, or sold by a firm would not provide incentives

21. To provide perspective, U.S. emissions of greenhouse gases in 2004 are estimated at approximately 7 billion metric tons.

22. For a discussion of early-reduction crediting, see Congressional Budget Office, *An Evaluation of Cap-and-Trade Programs for Reducing U.S. Carbon Emissions*, pp. 14-15.

for any form of sequestration. Thus, an upstream program would not provide such incentives. A downstream program could provide some incentives for sequestration, but only if allowance requirements were based on actual emissions. For example, consider a downstream trading program that required electricity generators to obtain allowances. That trading program could provide incentives for installing scrubbers that would capture and sequester carbon emissions, but only if generators' allowance requirements were based on their actual emissions. No such incentive would exist if allowance requirements were estimated on the basis of generators' fuel consumption.

Although a downstream program in which allowance requirements were based on actual emissions could provide incentives for some forms of sequestration, it would not provide incentives for other forms. For example, it would not provide any incentive for firms to offset their emissions with biological sequestration (such as growing trees). Policymakers could build in incentives for biological sequestration by allowing firms to meet some fraction of their allowance requirement by funding such initiatives. Although such sequestration projects could offer low-cost carbon reductions, they could also add considerably to the program's complexity and implementation costs because measuring, monitoring, and enforcing sequestration projects would be difficult.

Question 2. Allocation
Submitter's Name/Affiliation: (Congressional Budget Office)

Clarifying Questions 2e:

Special considerations for fossil-fuel producers?

- Would some upstream fossil fuel producers be unable to pass the cost of purchasing permits or allowances through in fuel prices if they are the regulated entity?
- Is there a sufficient policy rationale for addressing these costs to justify the complexity of setting up and administering an allocation system for these entities?
- What other options exist to address the inability of fossil fuel producers to pass through these costs?

Carbon emissions result from the combustion of fossil fuels, with some fuels leading to greater carbon emissions than others. For example, the amount of carbon released per million British thermal units (Btus) of coal is 1.8 times the amount released per million Btus of natural gas. Differences in the carbon content among fuels mean that some fossil fuel producers and suppliers could be better off as a result of the cap-and-trade program whereas others could be worse off. For example, natural gas producers could be better off if the policy caused electricity generators to switch from carbon-intensive coal to relatively less carbon-intensive natural gas. As a result, the natural gas industry could potentially experience increased profits and higher wages under an initial adjustment period. In contrast, the policy would probably decrease the demand for coal. Therefore, that industry could experience lower profits, decreased wages, and lost jobs, particularly as the industry adjusts to lower output levels. Assuming that allowances were granted on the basis of historic factors (such as a firm's previous production), the granting of allowances would not affect firms' future marginal costs or future production decisions. As a result, compensation provided to firms would be likely to benefit shareholders (it would be equivalent to a windfall gain) but would not be likely to reduce the costs borne by workers because it would not offset the decrease in production that the cap would induce.

The costs that fossil fuel producers would bear as a result of the cap would depend on underlying supply and demand conditions, not on whether they were the regulated entity—that is, required to hold allowances (this point is explained in more detail in the general observations following question 2). As such, the decision about whether to compensate fossil fuel producers (shareholders) or workers need not depend on whether they were the regulated entity.

Question 2. Allocation
Submitter's Name/Affiliation: (Congressional Budget Office)

Clarifying Questions 2f:

Allocations for downstream electric generators?

- Should electricity generators be included in the allocation if they are not regulated? (Clarification: We mean to ask if an electric generator should be included in the allocation if the greenhouse gas regulation occurs at a point of regulation that is upstream or downstream from the generator, but not the generator itself.)
- What portion of the total allocation should be granted to the electric power sector? Should it be based on the industry's share of greenhouse gas emissions or some other factor?
- Should generators in competitive and cost-of-service markets be treated differently under an allocation scheme?
- How should permits or allowances be distributed within the electric sector? Should it be based on historic emissions? Electricity output? Heat input?

As observed in the general discussion following question 2 above, the costs that entities would bear under a cap-and-trade program generally depend on the underlying conditions of supply and demand, not on whether those entities are required to obtain allowances for their emissions. As a result, decisions about whether to compensate electricity generators need not be linked to decisions about whether the allowance requirement is placed on them or upstream or downstream of them.

However, provided that policymakers decided to place the allowance requirement on electricity generators, there could be a reason why selling allowances to generators in cost-of-service markets would be more efficient than issuing them at no cost. In most cases, regulators include inputs at their "original cost" (actual prices paid for them) when calculating electricity prices.[23] As a result, allowances that generators receive at no cost would not lead to higher electricity prices in cost-of-service markets. (In competitive markets, that would not be the case because firms would reflect the opportunity cost of using the allowance—that is, the forgone revenue from not selling it—in the prices that they charge for electricity.) Failure to pass the opportunity cost of using allowances on to electricity customers, however, would provide consumers in cost-of-service markets with an insufficient incentive to reduce their use of electricity. As a result, allocating allowances at no cost to electricity generators in cost-of-service markets could increase the cost of reducing emissions, and auctioning allowances to generators in those markets would be more efficient.

The cap-and-trade program could impose higher costs on electricity generators, particularly those that burn coal. Those generators, however, are likely to pass much of those costs on to their

23. See Dallas Burtraw and others, "The Effect on Asset Values of the Allocation of Carbon Dioxide Emission Allowances," pp. 51-62.

customers in the form of higher prices (as discussed above, this is particularly likely in electricity markets with a high degree of competition). As a result, matching the industry's share of allowances to its share of greenhouse gas emissions would probably overcompensate generators because much of the cost of the cap would be passed on to electricity consumers.

The costs that an individual utility would bear would depend on whether it sells power in a regulated or competitive power region, its particular mix of generation assets, and whether it was in existence when the policy went into effect. Some utilities would be better off, and some would be worse off.[24] Efforts to match compensation to actual costs would have to take those factors into account.

Basing allocations on current production decisions (called output-based allocations) rather than on historic emissions or production decisions (called grandfathering) could increase the overall costs of meeting an emissions cap. A cap-and-trade program would be most effective at reducing the costs of attaining an emissions cap if the trading program provided equal incentives for businesses and households to engage in all forms of carbon-reducing activities: it should not provide greater incentives for some activities than for others. Provided that electricity is sold in a competitive market, a cap-and-trade program in which allowances (or a share of them) were grandfathered to existing firms would meet that condition, whereas a program in which allowances (or a share of them) were allocated to firms on the basis of their current production would not.

Allocations that were linked to historic emissions or production decisions would not affect electricity producers' future production decisions or future electricity prices. Thus, the costs associated with emitting carbon would be passed on to the firms and households that use electricity, providing them with an incentive to limit their use. In contrast, output-based allocations would link a producer's allowance allocation to its current production decisions. Thus, the costs of producing a unit of electricity would be subsidized by the allowances earned as a result of the additional production. As a result, output-based allocations would tend to encourage more electricity production and lower electricity prices. Lower electricity prices, in turn, would mean that the policy would not give firms and households as much incentive to limit their electricity use. Although output-based allocations could lower the costs that the cap-and-trade program would impose on electricity consumers, it would increase the overall costs of the program. Higher-cost emission reductions in other sectors would need to make up for the increased emissions (relative to grandfathering) in the electricity sector.[25]

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24. For a discussion of those factors, see Burtraw and others,"The Effect on Asset Values of the Allocation of Carbon Dioxide Emission Allowances."

25. For a more detailed discussion of grandfathering versus output-based allocations, see Congressional Budget Office, *An Evaluation of Cap-and-Trade Programs for Reducing U.S. Carbon Emissions.* Also see Dallas Burtraw and others, *The Effects of Allowance Allocation and the Cost of Efficiency of Carbon Emission Trading* (Washington, D.C.: Resources for the Future, April 2001).

Question 2. Allocation
Submitter's Name/Affiliation: (Congressional Budget Office)

Clarifying Questions 2g:

Allocations for energy-intensive industries?

- Is there a sufficient policy rationale to have an allocation to selected energy-intensive industries? What industries should be included in the allocation?
- What portion of the overall allocation framework should be reserved for these industries?
- What are the appropriate metrics for determining allocations across different industries?

A restriction on carbon emissions would lead to higher energy prices and thus would impose costs on energy-intensive industries such as steel, aluminum, chemicals, pulp and paper, and cement. Higher production costs for those industries would tend to decrease their competitiveness, particularly if the prices for their goods were determined in world markets (where higher production costs could not be passed on to consumers in the form of higher prices). As a result of those higher production costs, production levels, profits, and wages in those industries could decline.

Giving allowances to firms in energy-intensive industries could compensate shareholders for the reduction in profits. However, assuming that allowances were granted on the basis of historic factors (such as a firm's previous production), such allowances would not offset any reduction in the competitiveness of those industries because they would not lower the costs of producing the energy-intensive goods.[26] Correspondingly, giving allowances would not offset the costs that workers in those industries might bear as a result of the decrease in production.

26. The results would be different if the number of allowances that firms received was directly linked to their current, or future, production decisions (referred to as "output-based" allocations). In that case, firms would "earn" allowances on the basis of their production decisions—and the decline in production that would result from the cap could be less. As described in the discussion under clarifying question 2f, however, such output-based allocations would be inefficient—that is, they would increase the costs of obtaining any given amount of carbon reductions.

Question 2. Allocation
Submitter's Name/Affiliation: (Congressional Budget Office)

Clarifying Questions 2h:

Allocations to other industries/entities?

- What other industries/entities (e.g. agriculture, small businesses, etc.) should be considered in the allocation pool?
- What should be the basis for their share of the total allocation as well as for the distribution among such industries/entities?

The Congressional Budget Office has not written about this issue in the past and, as a result, has not offered a response to these questions.

Question 3. International Linkage
Submitter's Name/Affiliation: (Congressional Budget Office)

Should a U.S. system be designed to eventually allow for trading with other greenhouse gas cap-and-trade systems being put in place around the world, such as the Canadian Large Final Emitter system or the European Union emissions trading system?

Because emissions from anywhere in the world make the same potential contribution to warming, a mitigation program would minimize the costs of meeting any particular goal by placing the same price on emissions everywhere. Thus, if policymakers were to adopt cost-effectiveness as a guiding principle in controlling emissions, they would want to ensure that emission prices would be equalized across countries. One way to accomplish that goal would be to allow for the trading of emission credits or rights across international borders.

Nevertheless, international trading could raise or lower the domestic price of emissions and the overall costs of the domestic program, depending on what set of countries was included in the system and the relative stringency of participating countries' domestic programs. For example, if trading only involved developed countries, each with an emission target that required similarly proportionate reductions in baseline emissions, emissions trading would be likely to raise prices in the United States, benefiting owners of domestic emission credits but hurting fuel users. In contrast, if a trading system included developing countries such as India and China, and those countries had targets consistent with their projected baseline emissions, emissions trading could result in a dramatic decrease in the emission price in the United States.[27]

Further complications would arise if cap-and-trade systems in different countries had dramatically different rules. Significant variations among systems would be likely to significantly increase monitoring and enforcement costs. Even more complications in monitoring and enforcement would arise if a domestic trading system allowed for regulated entities to earn credits by sponsoring emission-reducing projects in countries that did not have any targets at all. Further, countries' ability to ensure that their emission target would be met could be limited if any participating country's system incorporated a safety valve, or limit on the maximum price, and if regulated entities in other countries were allowed access to credits available at the safety-valve price. For example, if the clearing price for emission allowances necessary to meet the cap in the European Union trading program was higher than a safety-valve price included in a U.S. trading program, then European firms could comply by purchasing U.S. allowances. If that was to occur, the emissions cap in the EU program would not be met.

27. See Congressional Budget Office, *The Economic Costs of Reducing Emissions of Greenhouse Gases: A Survey of Economic Models* (May 2003), p. 82.

Additional Topics
Submitter's Name/Affiliation: (Congressional Budget Office)

If there is an additional topic related to the design of a mandatory market based program that you would like to address, please submit comments on this form.

A cap-and-trade program for carbon dioxide emissions would offer a way to set an overall limit on the level of carbon dioxide emissions while relying on economic incentives to determine where and how emission reductions occur. Such a program would probably reduce the costs of meeting an emission-reduction target, but it would not necessarily balance actual costs with the expected benefits achieved by the target. As described below, including a "safety valve" in a cap-and-trade program could help achieve that goal.

A cap-and-trade program with a safety valve would combine an overall cap on total emissions with a ceiling on the allowance price. If the price of allowances rose to the ceiling (or safety-valve) price, the government would sell as many allowances as was necessary to maintain that price. Thus, if the safety valve was triggered, the actual level of emissions would exceed the cap. The cap would be met only if the price of allowances never rose above the safety-valve price.

If policymakers had complete and accurate information on both the costs and benefits of achieving various limits on emissions, the inclusion of a safety valve would not offer any economic advantages. With full information, policymakers could set the cap to the level at which the cost of the last ton of emissions reduced in order to meet the cap was equal to the benefit from that reduction. However, neither the costs nor the benefits are known with certainty. For that reason, the best policymakers can do is to choose the policy instrument that is most likely to reduce the cost of making a "wrong" choice. Choosing a cap that is too stringent would result in excess costs that are not justified by their benefits. The inclusion of a safety valve that limited the price of allowances to the expected benefits of incremental emission reductions would avoid that outcome.

The advantages of including a safety valve in a cap-and-trade program stem mainly from the fact that the cost of limiting a ton of emissions is expected to rise as the cap becomes more stringent, whereas the expected benefit of each ton of carbon dioxide reduced is roughly constant across the range of potential emission reductions in a given year.[28] Because the additional benefit created by each additional ton of carbon that is reduced as the cap is tightened is expected to remain constant (even though it cannot be known with certainty), yet the additional cost is expected to rise by an unknown amount, a safety valve could help prevent excess costs. A safety valve would limit the cost of additional emission reductions to the expected benefit of those emission reductions.[29]

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28. That constancy occurs because climate effects are driven by the total amount of carbon dioxide in the atmosphere, and emissions in any given year are a small portion of that total. Further, reductions in any given year probably would be considerably less than the total baseline emissions for that year.

29. Limiting emissions of carbon dioxide with a tax on carbon emissions (set equal to the expected benefit of reducing emissions by one ton) could offer additional economic advantages over a cap-and-trade program with a safety valve. If the costs of reducing emissions were greater than expected, the tax would perform in the same manner as the safety valve. However, if the costs of reducing emissions were less than expected (and thus, the cap was less stringent than might have been justified by actual costs and

benefits), the tax could offer additional advantages. The tax could motivate more emission reductions than would have been required by the cap—keeping the cost of emission reductions in line with the benefits that they were expected to create. Available research indicates that a price instrument, such as a tax or safety valve, would offer economic advantages over a cap as long as policymakers did not feel it necessary to make extremely large emission reductions in the near term to avoid passing a threshold level of atmospheric concentration—that is, a point at which incremental increases in emissions would lead to a large increase in the incremental damages caused by those emissions. For a more detailed description of the advantages that a tax and a safety valve offer, along with an illustrative example, see Congressional Budget Office, *Limiting Carbon Dioxide Emissions: Prices Verus Caps* (March 15, 2005).

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The Electric Power Research Institute (EPRI) has been actively engaged in climate policy research for almost 20 years. Our role is not to advocate specific policies, but to examine the implications of alternative policy choices so that we can inform public debate and private decision making. Two key perspectives guide our comments, the first being the critical importance of economic efficiency – achieving an environmental goal at least cost. Allowing emission reductions to be made when and where they are most economic along with inclusion of all greenhouse gases are fundamental tenets of economic efficiency.[1] The second key perspective is the realization that current policy proposals are an early step in addressing the issue of climate change. The ultimate effectiveness of a climate policy will be determined by its ability to provide the technologies necessary for making the transition to a low greenhouse gas emitting economy and how it evolves over the coming decades into a coordinated, international effort.

Question #1: Who is regulated and where? Economic analyses suggest that a cap-and-trade system should have as broad coverage as possible for at least three reasons: 1) to achieve any specified near-term greenhouse gas emissions target at lowest cost, 2) to make stabilization of greenhouse gases feasible, and 3) to allow the longer-term fundamental transformation of the energy system that is required to stabilize concentrations of greenhouse gases in the atmosphere. The point of regulation is: 1) not important from the perspective of environmental effectiveness, 2) not particularly important from the standpoint of economic efficiency (as long as coverage is the same), 3) very important in determining administrative feasibility, complexity and cost, and 4) independent from the decision about permit allocation.

Question #2 relates to allocation of permits without cost. Allocation of allowances without cost: 1) is unlikely to impact significantly the cost of the policy, 2) can partially or wholly offset large redistributions of income created by the policy but will likely require a significant fraction of permits,[2] and 3) should likely be revisited over time. While economic literature provides many insights into choices that affect cost-effectiveness, it provides little guidance about how costs should be allocated.

Question #3 relates to the importance of linkage with other trading systems. Climate change is a global issue. The potential benefits of integrating a U.S. trading system with other climate policies being implemented around the world are huge – it fosters engagement and cooperation with other countries, it can potentially provide substantial savings in policy cost, and it does not weaken the environmental integrity of a program.

Question #4 asks whether legislation should condition U.S. actions on comparable actions by others. The sequencing of country participation is both a strategic decision and one of equity. However, it is clear that stabilization of emissions, much less atmospheric concentrations, cannot occur without substantial participation by developing countries.

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[1] See Appendix A for a description of when, where, and what flexibility.

[2] There are a few published studies that suggest that companies' lost profits can be compensated by allocation without cost of a small fraction (e.g., 5-10%) of total permits. These theoretical findings depend on a number of idealized assumptions that are not likely to hold. Implementing such an approach is problematic.

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Appendix A

Economic analyses have shown that, whereas sizable emission reductions may entail substantial economic costs, the size of the costs can be reduced by measures designed to ensure economic efficiency. Specifically, providing flexibility as to "when", "where", and "what" gases are reduced can lower the costs of meeting stabilization goals.

When: Since climate change is a century-scale, cumulative emissions issue, flexibility in the timing of emissions reductions is critical for economic efficiency. Figure A-1[3] shows how an atmospheric CO2 concentration target may be achieved through either a rapid or a gradual transition to lower-emitting technology. An approach that permits gradual reductions initially with steeper reductions later has the smallest economic impact because a smooth transition minimizes the premature retirement of capital and allows time for the development and deployment of more advanced technologies that hold the promise of providing large, relatively inexpensive reductions by mid-century. To ensure that these options are available, however, public and private investment in energy technology development and deployment must be increased substantially over current levels in the very near term.

Where: Since the atmosphere is a commons, it does not matter where emissions are reduced. Policies offering flexibility in where emissions reductions occur yield significant economic benefit. Many of the lowest-cost potential emissions reductions are in developing nations like China, where substantial growth in generation capacity is planned, much of the current energy technology is dated and inefficient, and coal plays a large role both in direct use and in the generation of electricity. Policies employing "where" flexibility would enable the United States and other developed countries to obtain some credit for assisting developing nations in reducing emissions, helping achieve an agreed-upon international environmental goal at lower cost. See Figure A-2.

What: There are six categories of greenhouse gases (GHGs). While there is an understandable focus on CO2, reducing emissions of methane (CH4), nitrous oxide (N2O), sulfur hexafluoride (SF6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs) is also important. Methane, for example, leaks from natural gas pipelines, landfills, and coal mines. The economics of capturing this wasted gas can be attractive. Figure A-3 highlights the economic advantages of including other GHGs in climate policymaking.[4]

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[3] Studies typically present quantities of CO2 in either "tons of CO2" or in "tonnes (metric tons) of carbon". Our responses present results in the same units as the source material from which they are drawn. To convert from tonnes of carbon to tons of CO2, multiply by about four (e.g., global emissions of 6 billion tonnes of carbon are equivalent to 24 billion tons of CO2). Conversely, to convert $/tonne of C to $/ton of CO2, you divide by four (e.g., $240/tonne C is roughly equivalent to $60/ton of CO2).

[4] These economic efficiencies are unlikely to be realized if reduction targets are set based upon total GHG emissions, but procedures are in place for counting only CO2 emissions reductions – as is the case for some proposed policies.

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Finally, we note that there is an important distinction between the three flexibility mechanisms and the question of "who" pays. The issues of when, where, and what pertain to cost-effectiveness. Science and economics can contribute considerably to this debate. The issue of who pays is a question of equity and a matter for the political process. Nevertheless, it is essential that all major emitting countries participate. Analyses have consistently shown that developed countries cannot reach stabilization without the help of developing countries. See Figure A-4.

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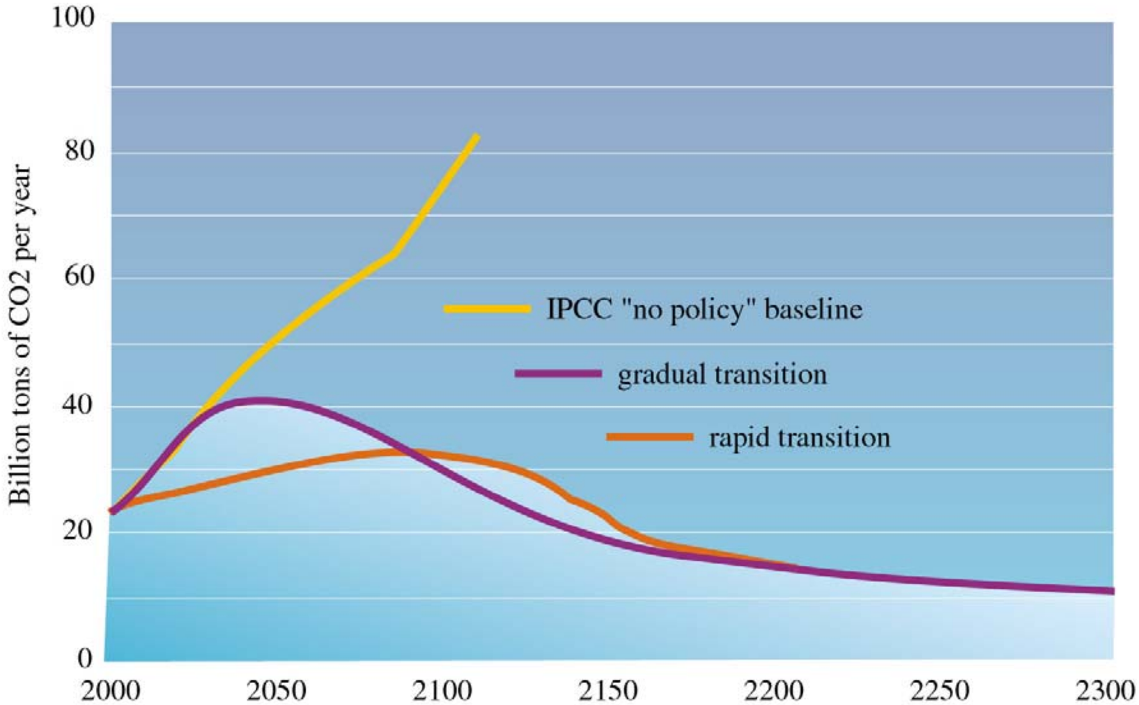
Figure A-1. Alternative emissions profiles for stabilizing atmospheric concentrations at 550 ppm. A concentration target may be achieved via many alternative emissions pathways. The environmental implications of alternative pathways to a concentration target are similar, but flexibility in the pace of the transition may have significant economic benefits. Flexibility in timing reduces premature retirement of capital stock and allows time for improving low- and no-emission technology choices.



Source: Wigley, T., R. Richels and J. Edmonds, 1996: Economic and environmental choices in the stabilization of atmospheric CO2 concentrations. *Nature*, **379**, January 18.

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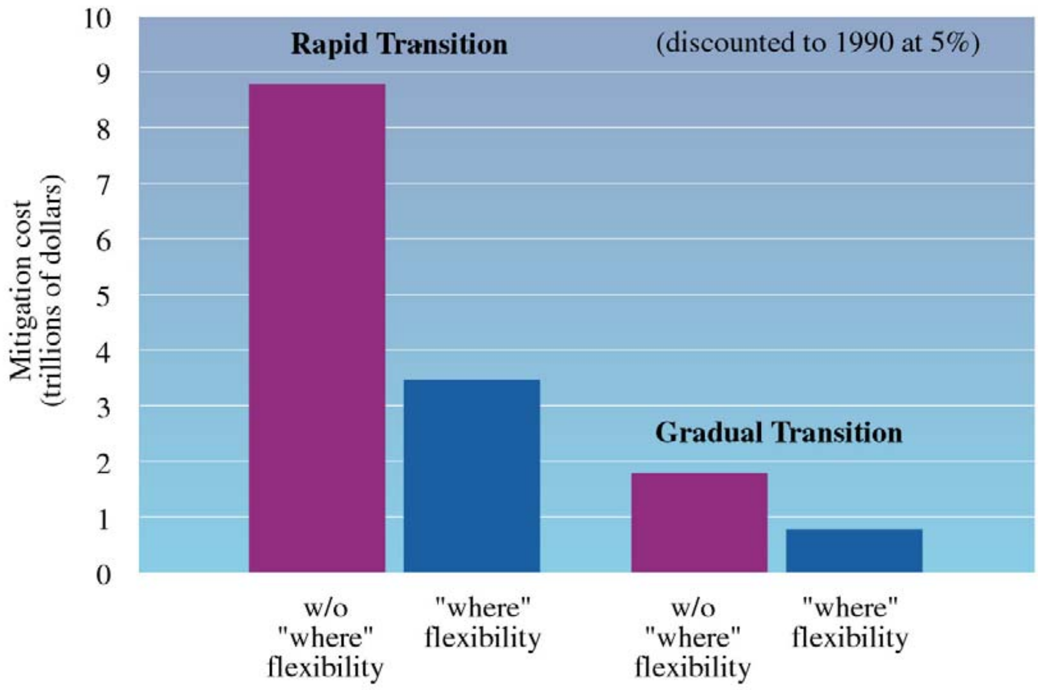
Figure A-2. Global costs of stabilizing concentrations at 550 ppm. While the environmental effects of a rapid transition or a gradual transition to a concentration target are likely to be very similar, the costs of the two pathways differ dramatically – illustrating the benefits of "when" flexibility in climate policy. Policies offering flexibility in "where" emissions are reduced offer additional economic efficiencies.



Source: Manne, A. and R. Richels, 1997: On stabilizing CO2 concentrations – Cost-effective emissions reduction strategies. *Environmental Modeling and Assessment*, **2**, 251-265.

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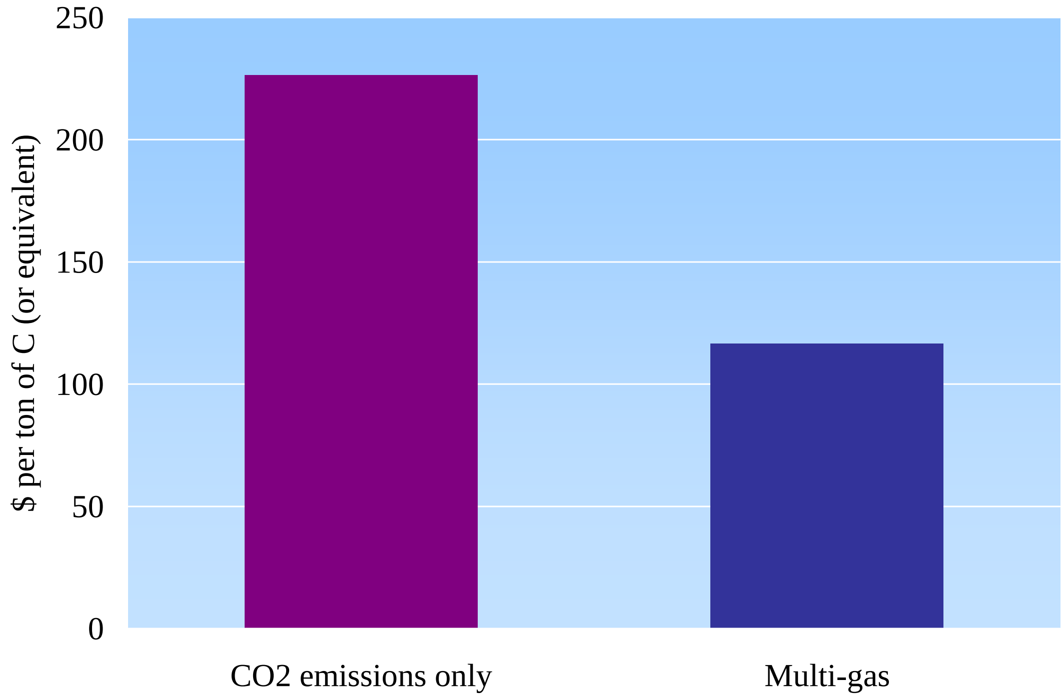
Figure A-3. Global cost of emission rights under a Kyoto policy for a CO2-only approach and a multi-gas approach.



Source: Manne, A. and R. Richels, 2000: A multi-gas approach to climate policy – with and without GWPs. FEEM Working Paper 44.2000, Social Science Research Network.

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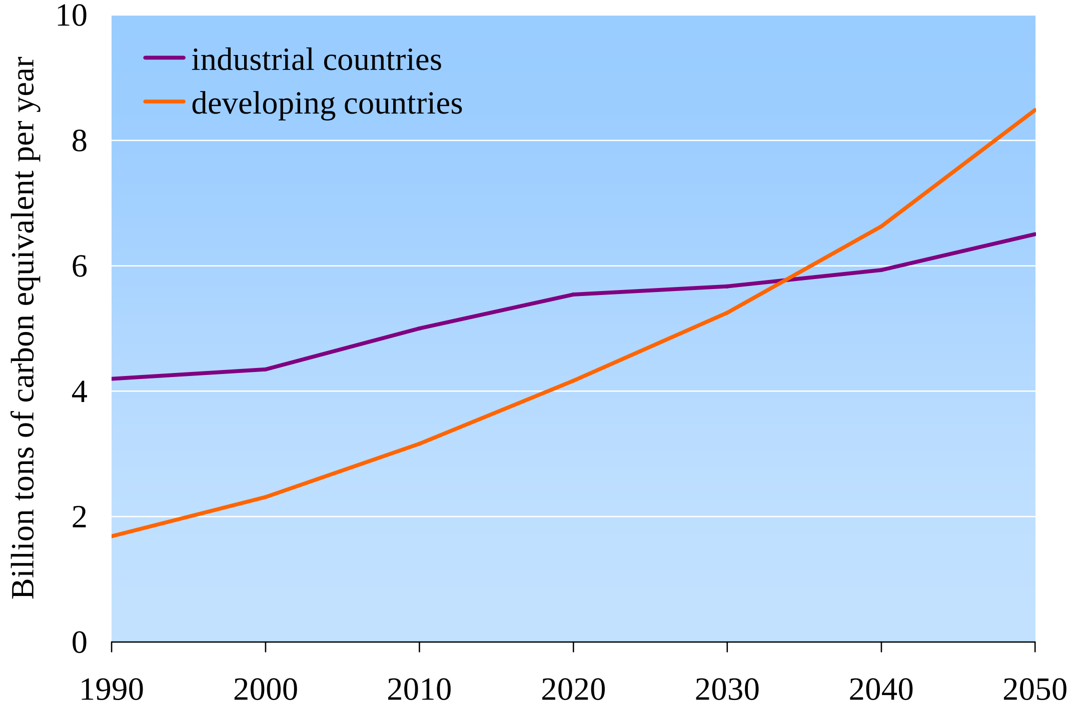
Figure A-4. Growth in carbon emissions by region. If current trends continue, developing world greenhouse gas emissions will surpass those of industrialized countries in the next several decades.



Source: National Commission on Energy Policy: 2004. *Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges*. Washington, DC. (Figure 2-5 (Global GHG Emissions) from A. Manne and R. Richels, 2004.)

Question 1. Point of Regulation
Submitter's Name/Affiliation: Richels & Wilson/EPRI

Who is regulated and where?

Economic analyses suggest that a cap-and-trade system should have as broad coverage as possible for at least three reasons: 1) to achieve any specified near-term greenhouse gas emissions target at lowest cost; 2) to make the stabilization of greenhouse gases feasible; and 3) to allow the longer-term, fundamental transformation of the global energy system from one that is 85% greenhouse gas emitting to one that is predominantly non-emitting.

1) **Economy-wide coverage yields lowest near-term costs.** Economic analyses consistently find that the cost of meeting a near-term, domestic emissions target is lowest when all emitters face a similar cost for emitting greenhouse gases, and reductions are made wherever they are least expensive. This is true internationally, often called "where" flexibility, and it is equally true domestically. Inclusion of all greenhouse gases, not just CO2, is a critical element in controlling cost. Although economic theory strongly suggests that emission reductions be made where they are least expensive, it provides little insight into who should pay for these reductions.

2) **Economy-wide coverage helps ensure that long-term environmental targets can be achieved.** Focusing on a subset of the economy, while leaving other reductions uncontrolled, may make stabilization infeasible. Large, individual CO2 emitters in the United States comprise only 50-60% of U.S. emissions. Controlling only these emissions in the near-term will lead to CO2-increasing substitutions (e.g., if central-station electricity is controlled, customers may substitute direct use of natural gas for electricity where possible). In the long-run, even reducing emissions in these targeted sectors to zero will not be enough to achieve stabilization. It should be noted that, from an international perspective, the United States and all other developed countries could reduce their overall emissions to zero and still not ensure stabilization. The necessity for global cooperation to meet environmental goals of climate policy is addressed in our responses to Questions 3 and 4.

3) **Consistent, economy-wide coverage allows and facilitates an efficient, long-term transformation of the energy system.** The context of the question suggests that a single system will be applied to all sectors. This consistent approach across all sectors of the economy is extremely important to minimizing policy cost – broad coverage is not enough by itself. Historically, environmental regulation in the United States and in other countries has differed markedly for different sectors of the economy – with cap and trade for some and CAFE (Corporate Average Fuel Economy) or efficiency standards for others. Such a piecemeal approach to address climate change would be unnecessarily costly, burdensome to implement over decades, and likely ineffective in the end.

   Stabilizing concentrations of greenhouse gases in the atmosphere ultimately requires a transition from a global energy system that is 85% CO2-emitting to one that is largely non-emitting. Guiding this transformation efficiently on a sector-by-sector basis (e.g., the U.S. Congress specifying separate targets for autos, power plants, and homes every five years) over the coming decades and centuries seems problematic.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Richels & Wilson/EPRI

The point of regulation:

- Is not important from the perspective of environmental effectiveness. An economy-wide cap on emissions provides the same cap whether it is implemented upstream (on carbon content of fuels), downstream (at point of emission), or midstream.
- May not be important from the standpoint of economic efficiency. Most economic models assume perfectly competitive markets. If this were a true representation of the economy, the point of regulation would not matter from an efficiency standpoint. Market imperfections—such as regulation or market power—do raise some concerns about efficiency, but should be dealt with as necessary, rather than avoiding administratively feasible coverage due to an existing market imperfection.
- Is very important in determining administrative feasibility, complexity, and cost. A downstream (point of emission) cap-and-trade system, as noted in the White Paper, seems infeasible for transport and residential sectors. An upstream system or a mixed system (e.g., a system with downstream coverage of electric utilities and, perhaps, large industrial facilities, and upstream coverage of other emissions) would require regulation of many fewer entities yet be able to achieve greater coverage.
- Should be independent from the decision about allocation of permits without cost. A system that regulates the carbon content of fuels, for example, could provide permits without cost to fuel suppliers, the electric sector, and end users. Although such permit allocations have historically gone to the regulated emitters, they can conceivably go to anyone.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Richels & Wilson/EPRI

Clarifying Question 1a:

- Is the objective of building a fair, simple, and rational greenhouse gas program best served by an economy-wide approach, or by limiting the program to a few sectors of the economy?

An economy-wide approach is essential—as noted in our response to Question 1—in order to achieve an emissions target at least cost, to ensure that long-term targets can be achieved, and to facilitate the long-term transformation of the energy system from one that is dominantly carbon-emitting to one that is dominantly non-emitting.

The issues of cost-effectiveness and the eventual need to cover all emissions are well understood and have been discussed extensively in the economic and policy literature over the last 20 years.[1] Less attention has been paid to the policy implications of the fundamental energy system transformation that is required to stabilize atmospheric concentrations of CO2.

For the last decade, EPRI—in cooperation with Pacific Northwest National Labs—has been examining this transformation and its implications for climate policies.[2-3] Figures A1-1[4] and A1-2 in Appendix 1 make clear the challenge of stabilization. Figure A1-1 depicts a set of emission pathways for stabilizing CO2 concentrations in the atmosphere at 650, 550, and 450 ppm (see Wigley *et al.*[5] for the initial description of these pathways). In each case, CO2 emissions growth slows, emissions peak above current levels and then decline in the coming decades. Figure A1-2 shows that emissions from electricity production follow a similar pattern. Increases in the electric sector emissions occur even though the carbon intensity (CO2/MWh) of the global electric sector is dropping (see Figure A1-3). The electric sector carbon intensity drops significantly over time in the reference case and dramatically over time in the stabilization cases as the energy and electric system is transformed from one that is largely carbon-emitting to one that is non-emitting. Figure A1-4 depicts the size of the electric sector (the relative size of the pie charts) and the composition of electric generation as this transformation occurs in the 550 ppm stabilization path. The technology transformation from a predominantly emitting system to one that is largely non-emitting is dramatic.

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1 IPCC (Intergovernmental Panel on Climate Change), 2001: *Climate Change 2001: Synthesis Report.* R.T. Watson (Ed.), Cambridge University Press, UK.

2 Edmonds, J., T. Wilson, M. Wise and J. Weyant, forthcoming: Electrification of the economy and CO2 emissions mitigation. Accepted for publication in a forthcoming special issue of the *Journal of Environmental Economics and Policy Studies*.

3 EPRI (Electric Power Research Institute), 2005: Program on technology innovation: Electric technology in a carbon-constrained world. *Technical Report*, **1013041**, December.

4 Studies typically present quantities of CO2 in either "tons of CO2" or in "tonnes (metric tons) of carbon". Our responses present results in the same units as the source material from which they are drawn. To convert from tonnes of carbon to tons of CO2, multiply by about four (e.g., global emissions of 6 billion tonnes of carbon are equivalent to 24 billion tons of CO2). Conversely, to convert $/tonne of C to $/ton of CO2, you divide by four (e.g., $240/tonne C is roughly equivalent to $60/ton of CO2).

5 Wigley, T., R. Richels and J. Edmonds, 1996: Economic and environmental choices in the stabilization of atmospheric CO2 concentrations. *Nature*, **379**(6562), 18 January, 240-243.

Figure A1-5 illustrates how the energy system may be fundamentally restructured in a carbon-constrained world. The figure portrays the electric share of total final energy for a mid-range IPCC reference case and for stabilization of CO2 concentrations in the atmosphere at 650, 550, and 450 ppm. In the reference case, electricity's fraction of the energy system is expected to continue the increase it has experienced since its introduction in the late 19th century. If climate policies are applied consistently across the entire economy (domestically, globally, or both), we find that electricity will play a greater role the tighter the stabilization target. This finding is not surprising when one considers that almost all non-emitting energy use today is electric. Looking to the future, economies of scale and the fixed nature of generation facilities make deploying some low carbon-emitting technologies (e.g., fossil with carbon capture, commercial biomass, some renewables, or nuclear) at power plants cheaper than trying to apply such technologies to the millions of small, dispersed emissions sources (e.g., direct combustion of fuels at commercial facilities or in home furnaces).

If a carbon constraint were instead focused solely on electric generation, and exempted any other sources of energy use (e.g., in commercial and home use), then the policy would have the perverse effect of reversing the beneficial direction towards greater electrification, and undermine our ability to meet long-term goals for greenhouse gas stabilization. It would cause consumers to move away from the more costly energy of the electricity sector towards uncapped energy sources that will be more costly to control once they become a target of regulation.

Policy Implications of this Long-term Energy Transformation

Creating this long-term transformation of the energy system in an efficient manner requires consistent signals about the value of CO2 emissions across the economy. It will be very difficult to provide these consistent signals if we follow traditional policy approaches, with different forms of policy for each sector. Separate sectoral policies would require a political determination each 5-10 years of how much of our allowable emissions will come from each sector. Providing a consistent, economy-wide CO2 price signal (e.g., via an economy-wide cap-and-trade system) is much less complicated, likely much less expensive, and it is separable from the issue of who pays for the reductions.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Richels & Wilson/EPRI

Clarifying Question 1b:

- What is the most effective place in the chain of activities to regulate greenhouse gas emissions, both from the perspective of administrative simplicity and program effectiveness?

The point of regulation:

- Is not important from the perspective of environmental effectiveness. An economy-wide cap on emissions provides the same cap whether it is implemented upstream (on carbon content of fuels), downstream (at point of emission), or midstream.
- May not be important from the standpoint of economic efficiency. Most economic models assume perfectly competitive markets. If this were a true representation of the world, the point of regulation would not matter from an efficiency standpoint. Market imperfections—such as regulation or market power—do raise some concerns about efficiency, but should be dealt with as necessary, rather than avoiding administratively feasible coverage due to an existing market imperfection.
- Is very important in determining administrative feasibility, complexity, and cost. A downstream (point of emission) cap-and-trade system, as noted in the White Paper, seems infeasible for transport and residential sectors. An upstream system or a mixed system (e.g., a system with downstream coverage of electric utilities and, perhaps, large industrial facilities, and upstream coverage of other emissions) would require regulation of many fewer entities yet be able to achieve greater coverage.
- Should be independent from the decision about allocation of permits without cost. A system that regulates the carbon content of fuels, for example, could provide permits without cost to fuel suppliers, the electric sector, and end users. Although such permit allocations have historically gone to regulated emitters, they can conceivably go to anyone.

Background and Discussion of the Point of Regulation

Greenhouse gas emissions are part of everyday life, originating from a wide range of activities that are intertwined throughout our modern economy. Their sources number in the hundreds of millions and vary in scale from large industrial and electricity generating plants to individual automobiles, hot water heaters, and furnaces. As a result, cost-effective mitigation of greenhouse gas emissions presents a new challenge to policy makers seeking to reduce these emissions.

One aspect of this challenge resides in the fact that the traditional approaches to emissions control targeted emitters (termed "downstream" regulation) and were designed for single, relatively homogeneous sectors whose emitting activities were more amenable to control under a given approach and not for much more complex arrays of dissimilar sources, as is the case with greenhouse gases. Emission reductions have been accomplished within sectors through either technology standards (e.g., catalytic converters for automobiles) or through market mechanisms (e.g., the U.S. SO2 regulations for the electric sector). Although these traditional sectoral approaches may appear comforting in their familiarity, they may prove extremely costly if applied to greenhouse gas control. They would likely lead to uneven burdens among different sectors of the economy and could considerably complicate policy evolution as the need for future policy adjustments arise.

Economic modeling indicates that a different approach, one that sends consistent signals to all sectors of the economy, would result in significant cost savings over these traditional approaches. These results suggest that focusing policy on the greenhouse gas content of fuels upstream in the energy chain could significantly enhance economic efficiency and reduce the associated administrative burdens. This shift in policy focus would likely reduce the price society will have to pay to mitigate greenhouse gas emissions and would also provide a policy framework more amenable to revision in the future. It is not without precedent – the upstream approach has, in fact, been used in every market approach that addressed a pollutant that was possible to monitor before the point of emissions. The previous examples were lead in gasoline and CFC phase-outs.

Implementation Issues

Figure A1-6 illustrates the diversity of the emitters of carbon in the United States. Although other nations vary in the precise composition of their emissions, this broad range of activities and diversity in scale of emitters holds for all.

An upstream market-based system, one that requires fuel producers to surrender allowances or pay a tax for emissions attributable to their products, could cover 90% or more of these emissions. Exemptions would be provided for non-emitting fuel uses (e.g., chemical feedstock; and, potentially, cases where carbon is removed from fuel and sequestered, such as IGCC with capture). Fuel users (both industries and households) would not be required to hold permits or be taxed, but would see increases in fuel prices commensurate with the increases in costs to fuel suppliers, moderated by their ability to pass increased cost through to customers.

By sending a price signal to all fuel consumers and allowing them to choose the most cost-effective approaches to lowering emissions, an upstream market-based approach would provide incentives to achieve emission reductions at lowest cost.

A downstream system aimed at emitters, in contrast, would require regulation of hundreds of millions of companies and individuals. Most policy proposals have addressed this implementation challenge by differentiating policies by sectors, establishing market mechanisms for some sectors (such as a cap-and-trade system for electricity generators and large industry), and utilizing technology standards or other means (including opt-out policies) to address remaining sectors. The European Union Emissions Trading Scheme (EU-ETS), for example, implements a trading system that covers less than 50% of economy-wide emissions. In order to implement Kyoto measures, this trading system will be supplemented by other actions such as taxes, efficiency standards, technology standards, and incentives in sectors not covered.

The administrative burdens of a downstream system comprised of a patchwork of separate sectoral policies will be greater than that of an upstream, market-based system simply due to the number of regulated entities plus the diversity of the types of programs that must be put in place. Over time, as the stringency of emissions targets is likely to increase, maintaining consistency across diverse sectoral regulations will create an additional and continual administrative burden.

Economics of Point of Regulation[6]

A carbon policy's cost will be substantially affected by its coverage of sources, the extent to which market policies are supplanted by "command-and-control" regulation, and the level of consistency in efforts across the economy. Policies that provide only partial coverage of sectors or actions resulting in emissions may be missing opportunities to make inexpensive reductions.

Clearly, if an emitting sector is not regulated, potentially cost-effective reduction opportunities are lost. Less obvious are the opportunities lost when efficiency standards are implemented. For example, a Corporate Average Fuel Economy (CAFE) standard—which controls the average efficiency of new motor vehicles—can be effective in reducing emissions per mile traveled, but will likely not reduce (and provides a small incentive to increase) the number of miles traveled. Finally, there can be substantial losses if some sectors are required to make significantly more expensive reductions than other sectors.

Figure A1-7 explores the latter two types of losses in efficiency by comparing an economy-wide upstream cap-and-trade system to a case in which roughly 80% of U.S. emissions are covered upstream, but automobile emissions are instead controlled through a 35 miles per gallon (mpg) CAFE standard for new vehicles.[7]

In this case, the hybrid policy provides the same coverage of emission sources as the upstream policy and provides the same level of emission reductions. However, it is twice as expensive as the upstream policy because 1) it provides a different mix of automotive reductions (efficiency improvements per mile versus reductions in miles traveled) than an increase in fuel prices would, and 2) it imposes a greater burden on the transport sector than would a policy that equated the marginal cost of reductions across sectors.

[6] Ross, M. and A. Smith, 2002: Upstream versus downstream implementations of carbon trading systems with revenue recycling and allowance allocations. Working paper, Charles River Associates.

[7] While it is unlikely that a hybrid system would actually cover 80% of emissions with a cap-and-trade system and instead might impose efficiency standards on commercial and residential buildings and energy end uses, these findings provide a basis for understanding the fundamental tradeoffs between market and hybrid policies.

Question 1. Point of Regulation
Submitter's Name/Affiliation: Richels & Wilson/EPRI

Policy Implications

Economic analyses suggest that consistent, economy-wide market-based regulation is much more cost-effective than hybrid systems comprised of sector-specific policies. In addition, it is easier to administer and to update as additional emission reductions may be required over time.

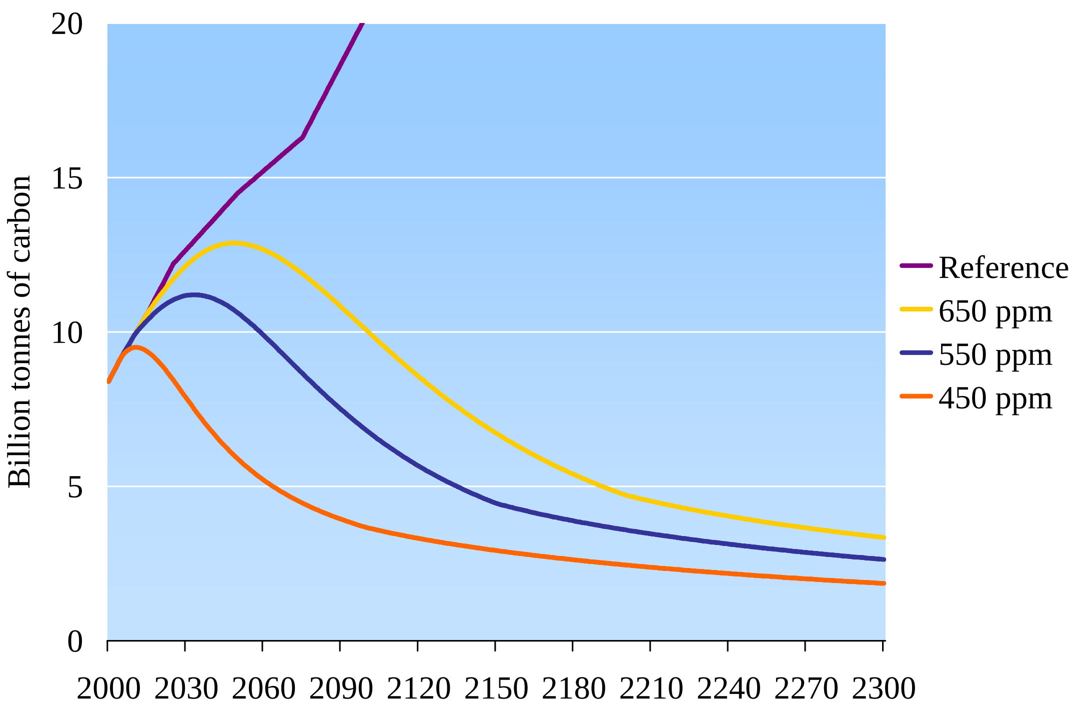
What are the arguments against a consistent, economy-wide approach? First, it may seem unfamiliar, but in fact it has already been effectively used to phase out the use of leaded gasoline and CFCs. Second are market imperfections – reality often differs from economic models. Market imperfections have two implications – for an economy-wide cap-and-trade system, desired reductions would be attained, but at a higher social cost than projected by models; for an economy-wide tax, the anticipated reductions may not be realized. A critical question is whether such market imperfections exist, and whether they can be removed where they do exist. (A classic example would be the regulated pricing of fuels, which can be modified by altering the regulation, if needed.) Finally, there is the political concern that an economy-wide cap-and-trade system looks like a tax to consumers, and taxes are not popular.

The clear costs of policies that impose taxes have repeatedly proven unpopular. As a result, it has traditionally been easier to implement more expensive policies that obscure costs rather than more efficient approaches that deliver results at lower, but clearer, costs. Given the high potential costs associated with climate policy proposals, this may not be a feasible political approach. Inefficient policies that obscure costs could unnecessarily cost U.S. consumers tens of billions of dollars annually.

Because of these worries and unfamiliarity, most policies and policy proposals in nations around the world have either focused downstream on emissions sources within a specific sector (or group of sectors) or have embraced hybrid regimes with some downstream focus and a mix of efficiency and technology standards to cover emitting activities not amenable to regulation at the source. These approaches generally allow some form of emissions trading within those sectors regulated downstream but leave significant activities outside of the trading system. This makes it much more difficult to provide a uniform incentive to pursue all the possible actions that could be undertaken to reduce emissions. As a result, these downstream and hybrid approaches fail to cover some—often significant—sources of emissions, and are unlikely to achieve emission reductions at least cost for the economy as a whole.

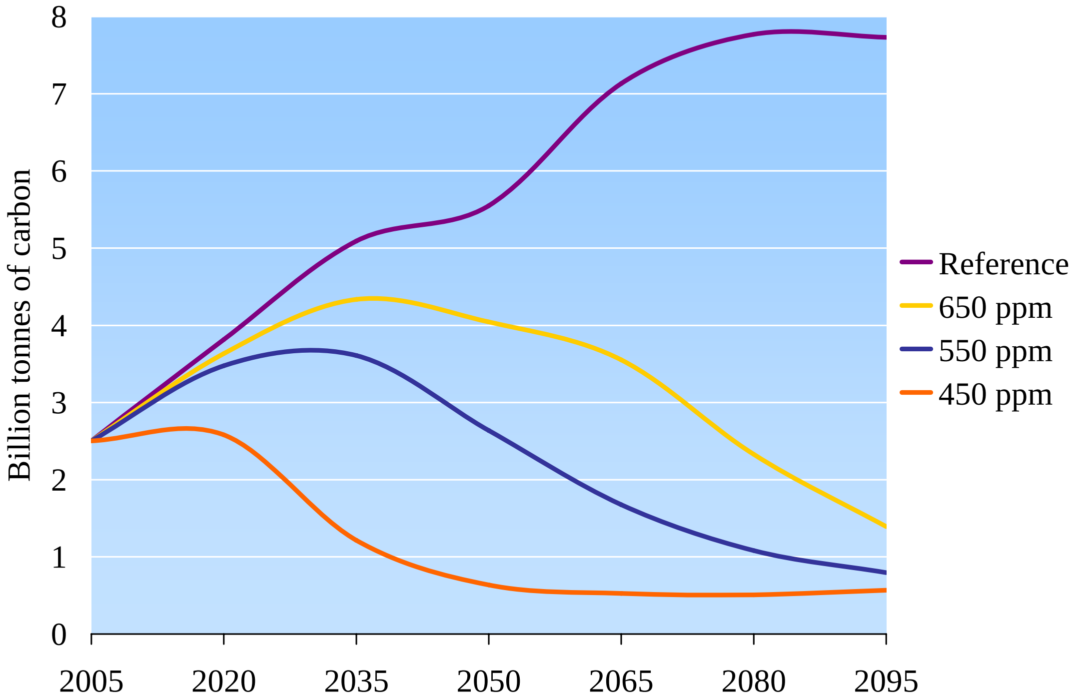
Question 1. Appendix 1. Point of Regulation
Submitter's Name/Affiliation: Richels & Wilson/EPRI

Figure A1-1. Emissions trajectories consistent with various atmospheric CO2 concentration ceilings.



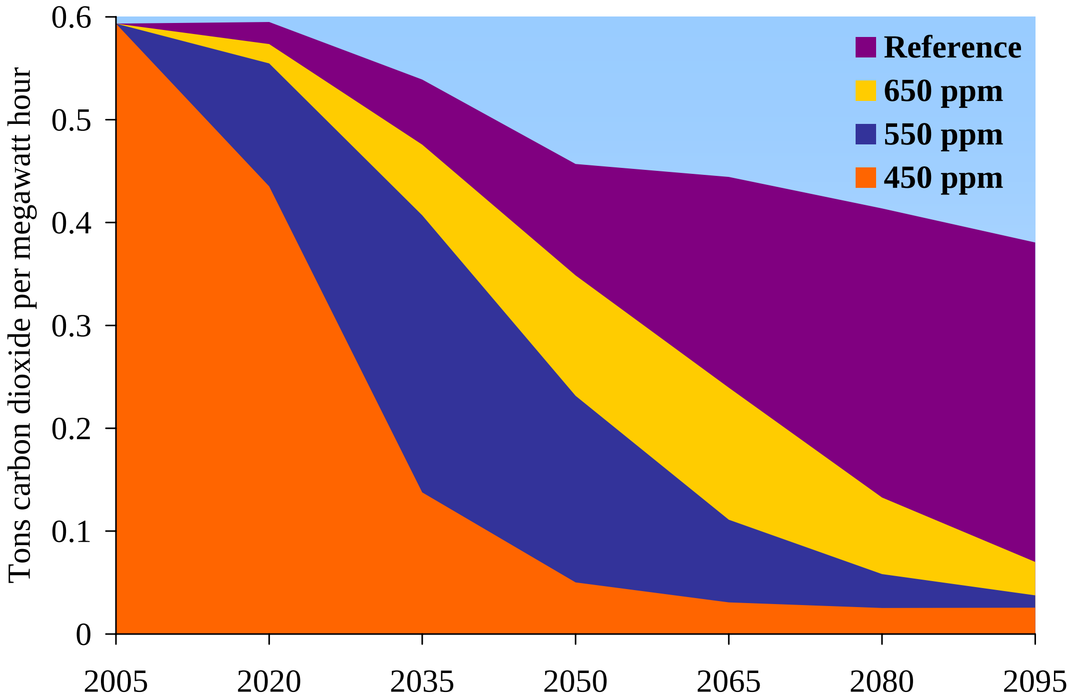
Source: EPRI (Electric Power Research Institute), 2005: Program on technology innovation: Electric technology in a carbon-constrained world. *Technical Report*, **1013041**, December.

Figure A1-2. Global electric sector carbon emissions.



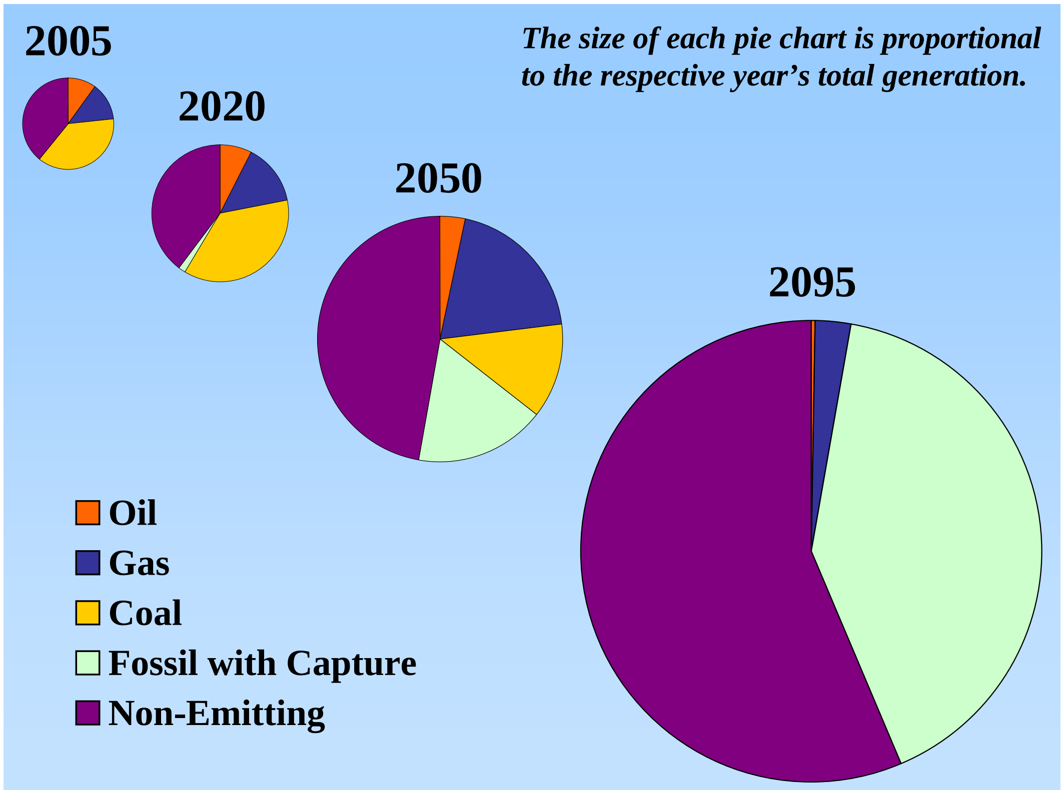
Source: EPRI (Electric Power Research Institute), 2005: [previously unpublished model outputs from analyses documented in] Program on technology innovation: Electric technology in a carbon-constrained world. *Technical Report*, **1013041**, December.

Figure A1-3. Global electric sector carbon intensity.



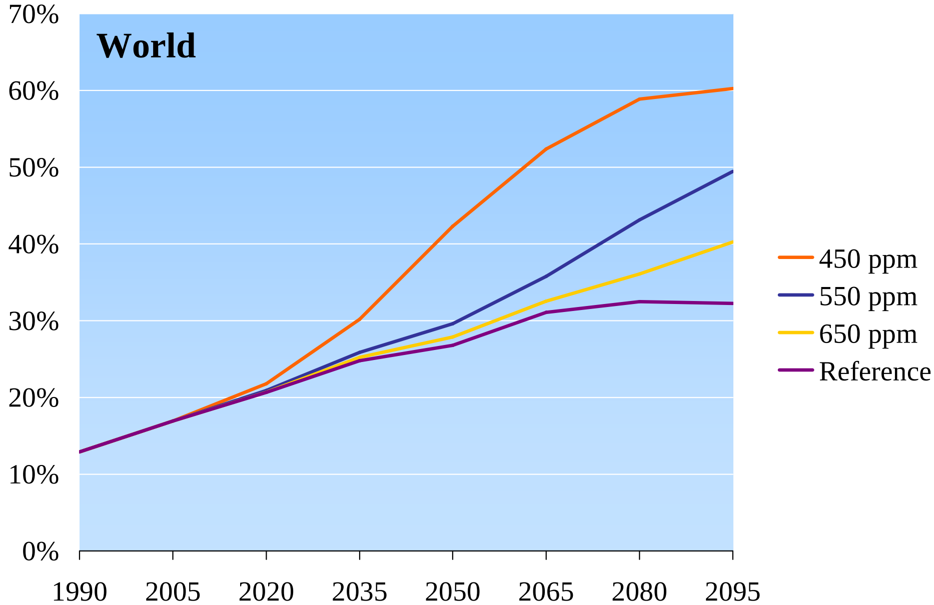
Source: EPRI (Electric Power Research Institute), 2005: [previously unpublished model outputs from analyses documented in] Program on technology innovation: Electric technology in a carbon-constrained world. *Technical Report*, **1013041**, December.

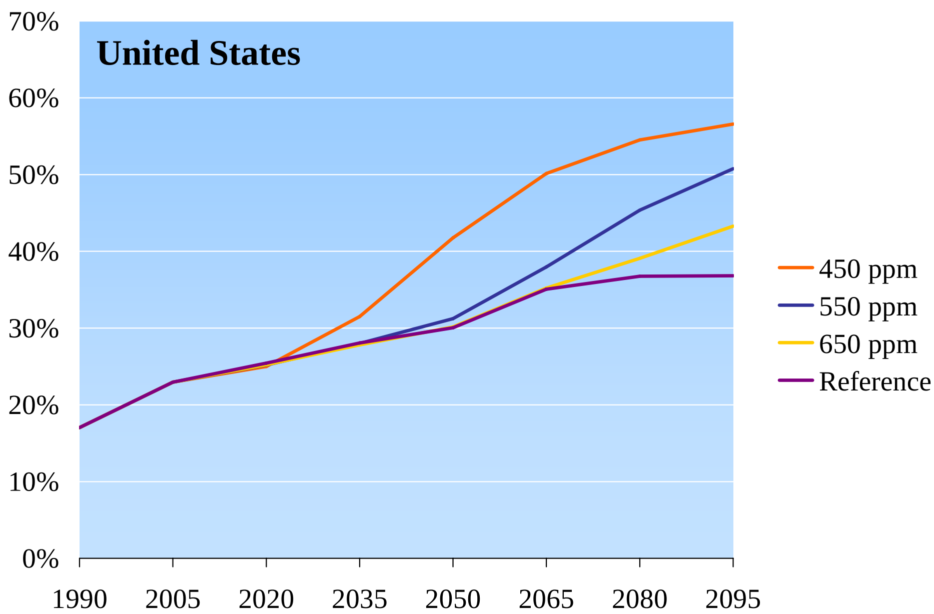
Figure A1-4. Global electric generation by fuel type – stabilization at 550 ppm.



Source: EPRI (Electric Power Research Institute), 2005: [previously unpublished model outputs from analyses documented in] Program on technology innovation: Electric technology in a carbon-constrained world. *Technical Report*, **1013041**, December.

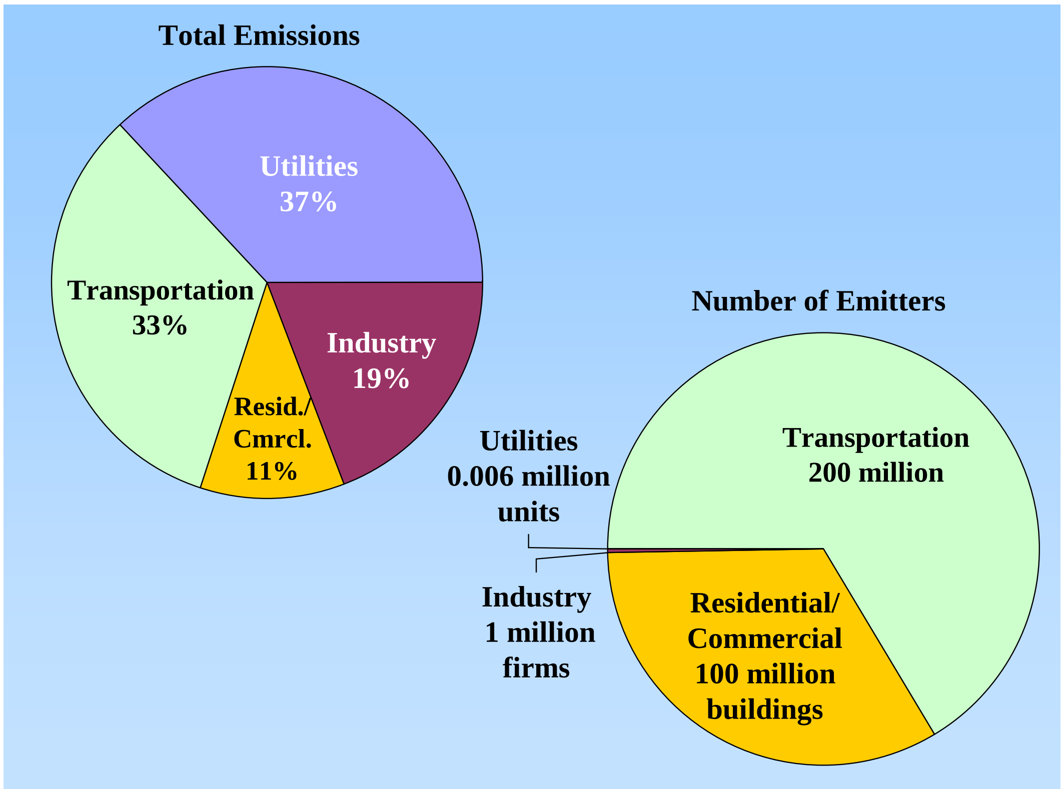
Figure A1-5. Electrification trends with carbon constraints. Ratio of electricity production to total final energy use shows similar patterns of growth for the world and the United States. The tighter the emissions constraint, the greater the role electricity plays in the energy system.





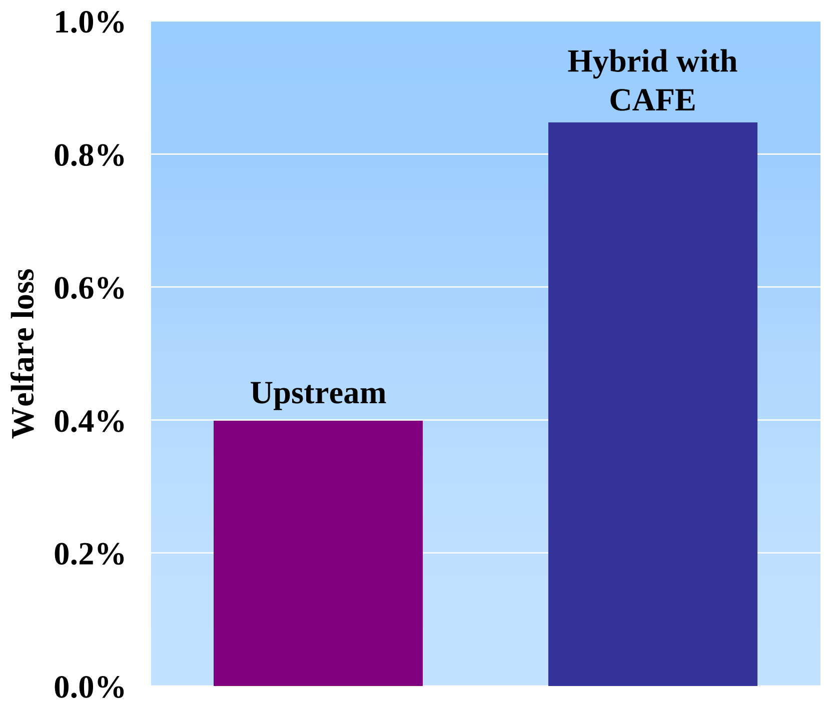
Source: EPRI (Electric Power Research Institute), 2005: Program on technology innovation: Electric technology in a carbon-constrained world. *Technical Report*, **1013041**, December.

Figure A1-6. Sources of U.S. carbon emissions in 2000.



Source: EPRI (Electric Power Research Institute), 2005: Upstream and downstream approaches to carbon dioxide regulation. *Climate Brief*, **1007762**, January.

Figure A1-7. Welfare losses under alternative scenarios for carbon trading systems.



Source: EPRI (Electric Power Research Institute), 2005: Upstream and downstream approaches to carbon dioxide regulation. *Climate Brief*, **1007762**, January.

Question 2. Allocation
Submitter's Name/Affiliation: Richels & Wilson/EPRI

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

The allocation of allowances in a trading system:

- **Is unlikely to impact significantly the cost (economic efficiency) of the policy.** The economic argument—that revenues collected from an auction can be used to reduce inefficiencies in existing tax code and thereby partially offset the societal cost of the program—is dependent on a number of governmental choices that have not occurred in the past. Thus, allocation of allowances at no cost affects who bears the burden of policy costs, but likely not the total cost.
- **Can partially offset large redistributions of wealth created by the policy.** Climate stabilization requires, in the long run, a near-complete re-tooling of the global energy system. Climate policy will have significant net costs and all participants cannot be compensated. Policies that reduce the cash flow and/or credit worthiness of companies, while requiring that they make substantial new investments in lower-emitting capital, may be problematic. If the policy were to have such effects, allocations might be used to mitigate the impacts.
- **Should be revisited over time as priorities change and as we learn from experience.** It seems clear that allocating allowances at no cost to companies in 2100 based upon (for example) 2005 historic emissions has little logical basis. Companies will be fundamentally different and the emitting capital investments that are being compensated will be long-retired in 2100. Fundamental priorities governing compensation will likely change significantly over the coming decades and much will be learned as policy evolves domestically and internationally.

The fraction of permits that it makes sense to allocate at no cost and the allocations reserved for specific industries and purposes (e.g., to spur technology innovation, or to fund adaptation) will depend upon when they are allocated.

The "rule of thumb" noted in the White Paper—that allocation of a small fraction of permits (often noted as 5-10% of <u>total</u> permits) at no cost can be used to offset lost profits in the energy industry—is based upon a number of idealized assumptions which are not likely to hold. First, some important sectors are regulated (e.g., the majority of coal-based generation operates under cost of service regulation). For these facilities, estimates of lost profit are inappropriate.

Even for companies that operate in deregulated markets, the rule of thumb is based upon idealized assumptions that are not likely to hold. Besides the fundamental issue that estimating company profits is problematic over years (and even more so over decades), the early literature on this topic evaluated perpetual allocations rather than 10-15 year allocations. The difference, as noted in our background piece below, can be dramatic – perpetual allocations require only 6% of total allowances in our analysis, while 75% of total allowances are required at no cost if the allocation is only offered for 10 years.

In support of our comments, we provide a background piece that examines the cost of climate policy, the implications of revenue recycling, and the notion of compensating lost profits.

Background Discussion of Revenue Recycling and the Cost of Climate Policy and Compensation

Climate policy has the potential to create a significant new source of government revenue. Economists have argued that, if governments were to use these revenues to reduce existing marginal tax rates, some of the costs of climate policy could be offset by increased efficiency elsewhere in the economy. Recent analyses indicate that a number of crucial conditions must be met in order for the potential cost reductions associated with *revenue recycling* to be realized. The most critical of these is that *marginal* tax rates be reduced with the new revenues from a carbon allowance auction or tax.

Climate Policy: A Potential New Revenue Source

Most discussions of climate policy focus on market mechanisms for reducing greenhouse gas emissions. Market-based policies assign an economic value to carbon either explicitly (i.e., via a tax) or implicitly (i.e., via an emissions cap-and-trade system), and they allow regulated entities to make their own decisions about how to alter emissions.

A tax policy or a cap-and-trade policy where emission rights are auctioned could raise significant revenue, the magnitude of which would be determined by the level of emissions and the amount of the tax or the stringency of the cap.

In the United States, where greenhouse gas emissions totaled 1,892 million tons of carbon equivalent in 2003,[1] a tax of $25/ton C (about $7/ton CO2) would raise revenues of $47 billion annually.

Potential Benefits of Recycling

Some existing taxes (arguably) produce a net drag on economic performance by creating disincentives to work (in the case of wage-related taxes) or to invest (in the case of taxes on interest, dividends, capital gains, and corporate income). If new climate policy revenues were

[1] Studies typically present quantities of CO2 in either "tons of CO2" or in "tonnes (metric tons) of carbon". Our responses present results in the same units as the source material from which they are drawn. To convert from tonnes of carbon to tons of CO2, multiply by about four (e.g., global emissions of 6 billion tonnes of carbon are equivalent to 24 billion tons of CO2). Conversely, to convert $/tonne of C to $/ton of CO2, you divide by four (e.g., $240/tonne C is roughly equivalent to $60/ton of CO2).

used to replace these revenues, allowing marginal tax rates to be reduced, the resulting general economic benefit could offset some of the costs of the new policy.

Initially, economists thought that the economic benefits of revenue recycling might completely offset the cost of an environmental policy and actually improve welfare. Such a situation is characterized as a *strong double dividend*. However, estimating these effects is complex. It requires tracing the implications of the various elements of the tax code back through the economy to households – who ultimately own all labor and capital assets. Untangling these complexities requires the use of empirically-based, computable general equilibrium models that address both the relevant sectors of the economy and existing tax codes.

In general, numerical and analytical studies across a range of nations and climate policies have shown that revenue recycling would yield a *weak double dividend*, offsetting just a fraction of the cost of a range of possible climate policies.[2] For example, in analyses of the U.S.,[3] revenues through personal income taxes—compared to lump sum recycling—could potentially offset up to 40% of the costs of two hypothetical U.S. climate policies (see Figure A2-1 in Appendix 2). Babiker *et al.*[4] indicate that even weak benefits may not be realized in some European countries if the existing tax structure is sufficiently distortionary.

Necessary Conditions to Achieve Recycling Benefits

Several key conditions must be met for the revenue recycling benefits of climate policy to be realized:[5-6]

1. **Significant net revenue must be raised.** Most analyses suggest that climate policies would reduce economic growth and, correspondingly, general tax revenue. As Figure A2-2 suggests, a significant fraction of gross revenues from climate policy would need to be used to offset this erosion in the general tax base. If the erosion is not offset, then tax rates will have to be increased, adding to—rather than diminishing—tax distortions, and thus exacerbating the overall effects of the carbon policy. It also suggests that if the required offset is not fixed, it will likely increase with time. Different climate policy instruments would cause differing levels of erosion, affecting the amount of revenue available for recycling.

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[2] IPCC (Intergovernmental Panel on Climate Change), 2001: *Climate Change 2001: Mitigation: Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. B. Metz et al. (Eds.), Cambridge University Press, UK.

[3] Bovenberg, L. and L. Goulder, 2000: Neutralizing the adverse industry impacts of CO2 abatement policies: What does it cost? Working paper presented at the *FEEMNBER Conference on Behavioral and Distributional Effects of Environmental Policy*, Milan, Italy.

[4] Babiker, M., G. Metcalf and J. Reilly, 2002: Tax distortions and global climate policy. Report Series #85, Massachusetts Institute of Technology Joint Program on the Science and Policy of Global Change, http://web.mit.edu/globalchange/www/reports.html.

[5] Ross, M. and A. Smith, 2002: Implications of trading implementation design for equity efficiency trade-offs in carbon permit allocations. Working paper, Charles River Associates.

[6] Smith, A. and M. Ross, 2002: Allowance allocation: Who wins and loses under a carbon dioxide control program? Working paper prepared for the Center for Clean Air Policy.

2. **Revenue must be used to reduce marginal tax rates.** Proposals giving policy revenues back on a per-person or per-household basis would not yield any macro-economic improvements because they would not alter incentives to work or invest. Proposals to use a portion of the funds to compensate affected parties would also reduce the funds available for recycling.
3. **The tax code must be changed to improve economic efficiency, which may prove problematic.** Most of the key parts of the tax code that would have to be modified to achieve welfare benefits were identified long ago by economists as placing a high burden on the economy. Nonetheless, they have remained durable parts of the tax code. New tax legislation is the product of many compromises, and there is no precedent in the United States for simple tax legislation that combines the creation of one source of revenue with the reduction of a more burdensome marginal tax rate.

In addition, emissions allowance auctions do not provide a stable source of revenue. Allowance prices may vary significantly from year to year and be governed largely by the actions of other countries. As a result, it would be hard to trust a climate policy to provide revenues consistently and to plan government budgets around such revenues. This volatility could decrease the likelihood of sustained efforts to use climate revenue to adjust tax codes.

Policy Implications of Revenue Recycling Discussion

Achieving the promised savings from revenue recycling will be difficult. Most economic analyses of climate policies assume no effect, positive or negative, from the disposition of revenues. For analyses that assume effective recycling, it is important to understand what the policy cost would be if the three necessary conditions outlined here are not met and, consequently, the recycling benefits are not realized.

Discussion of Compensation through Permit Allocations

Carbon policies will have significant impacts on the financial values of many businesses, especially those engaged in energy production. One suggested method of alleviating these effects involves using permit allocations to compensate firms for any asset losses. Studies have estimated that this may be possible using a relatively small fraction of available permits (i.e., around ten percent), leaving a substantial portion for accomplishing other goals. The idea of compensating lost profits is not relevant for companies whose profits are regulated (e.g., a large fraction of coal-fired electricity generation). The following paragraphs examine this finding and why it is likely inappropriate for deregulated companies as well.

The main reason why small percentages are predicted is that the total value of permits can be huge. Depending on the specific policy, their worth can be in the tens to hundreds of billions of dollars per year. Given these values, it becomes apparent why allocating only ten percent of all permits to energy industries may be sufficient to offset the energy industries' financial losses.

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Estimated losses by energy industries generally are between five and 50 percent of initial assets, depending on the severity of policy and the industry in question. This implies that—in dollar terms—financial losses are quite large, and if they are to be covered by allocating a small percentage of permits, the value of the permit stock from which they are taken must be very large.

It is only possible to cover these losses with a small percentage of permits under ideal conditions, and by using the most expansive measure of the value of permits. Previous work (Bovenberg and Goulder, and Smith and Ross) has assumed that allocations of permits for compensation purposes are perpetual. The assumption that allocations are not phased out over time means that a small percentage can have a large value because the permits are received each year for an infinite number of years.

It seems more reasonable to expect that compensation will be provided over a relatively small number of years, rather than occur forever. One justification for this is that future costs will be capitalized into immediate financial losses as investors revise their expectations about an industry's future prospects. The promise of a perpetual allocation of permits will only compensate if the market believes it, which is difficult in a constitutional environment in which no Congress can bind future Congresses to continue the allocation. In addition, since the firms experiencing losses may change over time, or the policy itself may change, a short compensation period may be desirable for equity and to provide desirable flexibility to change policies in the face of new circumstances.

Altering this central assumption about the length of compensation can have a dramatic effect on estimated percentages. If allocations are only provided over ten to twenty years, offsetting financial losses by energy businesses may easily require most—or all—available permits, ignoring any losses by other types of firms or by labor groups.

Another reason for avoiding perpetual compensation has to do with the uncertain value of permits. While models used for these analyses assume the future is known with certainty, businesses are likely to place less value on allocations of permits received far in the future. Taking this risk adjustment into account would raise estimated necessary allocations.

Allocating a small fraction of permits will not be sufficient if, as many have proposed, emission trading is combined with regulatory measures or confined to specific sectors. Past research efforts have all looked at an efficient, economy-wide implementation of a carbon cap. By including all emission sources under the cap, the total value of permit revenues is much higher than it would be if some sectors of the economy were exempted from the program. Relaxing this assumption can also significantly raise the percentages estimated to be required for compensation – or even make full compensation infeasible.

Modeling

Ross and Smith[7] explored how varying some of these basic assumptions might alter conclusions drawn about compensation for industries. The analysis was conducted using MRN, an intertemporal market equilibrium model that includes tax distortions and consumer preferences for driving a stock of vehicles. The policy backdrop for the study was a scenario in which all developed countries reduced their carbon emissions to year 2000 levels by 2010, without any international trading of carbon permits.

Two of the cases investigated examine the issue of perpetual versus ten-year allocations:

- **Case 1: Perpetual.** An upstream, economy-wide implementation with perpetual compensation of energy-intensive industries. This approach is similar to that used in previous papers and provides a point of comparison for Case 2.
- **Case 2: Ten years.** An upstream, economy-wide implementation with compensation provided over ten years, rather than forever. The value of permits allocated is again sufficient to offset declines in asset values, even though it is received over a short period.

Figure A2-3 shows carbon revenue and compensation results for Case 1. The total shaded area indicates the gross potential auction revenue (equal to the number of permits times the permit price). The purple-shaded area highlights the extent to which the carbon policy causes a general decrease in economic activity, thereby lowering government revenue from non-carbon sources ("tax base erosion"). The findings indicate that 40 to 60 percent of all carbon revenue may be needed by the government merely to maintain existing programs. Once this "erosion" is considered, the remaining revenue available for other purposes like compensation ("net auction revenues") is considerably smaller.

MRN estimates that asset values of energy firms will decline by between eight and 50 percent, depending on the industry. Six percent of total gross carbon revenues would be needed to maintain their original financial value. Although this is a small percentage, its value is equal to almost 200 billion dollars.

To provide the same dollar amount of compensation over a ten-year period would require approximately 75 percent of net carbon revenues, once erosion is considered (Figure A2-4). Although the value of compensation is the same, removing the assumption of perpetual compensation changes the results from a small percentage of permits to most of those available. On the other hand, after compensation is completed in ten years, more revenue will be available for other uses than would be the case under a perpetual system.

Even these conclusions may underestimate the fraction of permits required for compensation. None of the economic studies examine how the allocation to individual firms would be accomplished in practice. An assumption implicitly made by these types of models when estimating compensation is that winners within an industry will compensate losers – or that the

[7] Ross, M. and A. Smith, 2002: Upstream versus downstream implementations of carbon trading systems with revenue recycling and allowance allocations. Working paper, Charles River Associates.

government can give a negative allocation of permits to winners in order to provide sufficient compensation to losers. The administrative complexity and lack of information required to accomplish such a redistribution, let alone equity issues, make such an approach unlikely. If the more efficient firms within an industry are not required to help pay for losses by less efficient ones, required compensation estimates increase significantly – and even more equity issues arise.

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Clarifying Questions 2a:

Technology R&D and Incentives

- What level of resources should be devoted to stimulating technology innovation and early deployment?
- What portion, if any, of the revenues from permits or the auction of allowances should be reserved for technology development? If some portion is reserved for this purpose, should that set-aside flow to the federal government with funds spent through the traditional appropriation process? Or should the funds be allocated directly to a non-profit research consortium, chartered by the federal government, which would then administer technology development and deployment projects? Or should there be some combination of these two options?
- What criteria should be used to determine how such funds are spent and which projects are chosen?
- What other mechanisms should be used to promote technology deployment? Options include tax credits, cost-sharing for demonstration projects, assistance to state energy programs, etc.

Funding for technology R&D and incentives for early deployment of new technologies are essential elements of environmentally-effective and economically-efficient climate policy. A carbon price alone is an inefficient and likely ineffective way to get the needed technological breakthroughs. Technology R&D needs are immediate – <u>now is the time to explore new low-emitting technologies to enable their widespread deployment in 2030 and beyond</u>.

Discussion of the Need for Technology Policy

While near-term emissions limitations may be an efficient way to encourage deployment of existing technologies and to create evolutionary technology improvements, they are not only an extremely costly way to create long-term, fundamental technology advances, they may also be ineffective. (See, for example, Montgomery and Smith.[8])

Market-based approaches, which transform emissions into valued resources, have proven successful for reducing releases of sulfur dioxide (SO2) and nitrogen oxides (NOX) in the United States. For these cap-and-trade programs, the policy objective is to encourage least-cost, near-term control actions for meeting an emissions target and timeline across a defined, regulated community and geographic area. Regulated entities choose among a large array of available retrofit technologies, process changes, trading opportunities, and other options to define their own least-cost strategies for managing emissions allowances. Other market participants, such as

[8] Montgomery, D. and A. Smith, forthcoming: Price, quantity and technology strategies for climate change policy. *Human-Induced Climate Change, An Interdisciplinary Assessment*. Cambridge University Press, UK.

speculative interests, also trade in these commodities. At an aggregate level, market forces greatly reduce overall policy costs because controls are selectively applied where the cost per unit of emissions reduction is lowest. Additional policy efficiencies occur because market participants are able to realize immediate returns on short-term investments in research, development, and deployment of technological innovations.

Absent fundamental innovations in non- and low-emitting energy technologies, meaningful reductions in greenhouse gas emissions are impossible. Advanced components and systems will require decades to research, develop, and deploy. This creates a fundamental disconnect between when huge research and development investments must be initiated (now) and when significant emissions constraints may be imposed (later).

Economically-appropriate, near-term price signals—aimed at achieving initial, inexpensive reductions—are, by themselves, incapable of motivating the private sector to invest in the long-term technological improvements necessary to bring the cost of meaningful reductions down to acceptable levels. Stronger near-term signals are much more expensive to society, and the investments they are likely to compel—in natural gas capacity, in more efficient transportation technologies based on internal combustion engines, and in today's low- and non-emitting options—will not contribute substantially to climate stabilization goals.

Climate policies that specify an intention to tightly constrain emissions in the future, at the point when advanced technologies become available, are also incapable of providing the private sector with adequate incentives. For two reasons, the so-called *announcement effect* will fall on deaf ears:

1) The uncertain nature, pace, and extent of climate change means that any future constraints specified today are only projections based on incomplete information. The private sector is unlikely to respond to announced long-term price signals that are almost certain to change as conditions evolve, knowledge improves, and policy emphases vary.
2) Near-term R&D investments can only be motivated by the expectation that future price signals will be high enough to guarantee returns on expenditures that will be incurred over the course of several decades. This is improbable, regardless of scientific uncertainties about climate change.

In the case of cap-and-trade programs, competition to achieve least-cost reductions will drive the future price of emissions allowances down to the future cost of building and operating the new technology. However, this price will not account for R&D expenditures unless the investors become monopolistic suppliers of successful innovations – an unlikely situation because the energy transition will require technology advances founded on new scientific knowledge, and will be embodied by a complex of new technical capabilities. Similarly, if the policy were a carbon tax or cap-and-trade system with a safety valve, the government would likely adjust price signals for economic efficiency – lowering them from the level announced in order to motivate R&D to the level required to spur deployment of the advanced technology. Incentives for technological innovation must, therefore, be created by some means other than purely market-based policy mechanisms.

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Technology Policy is a Critical Element of Climate Policy

To create the needed technology advances, climate policy must include a strong technology component both to focus public sector investment on productive areas of science and technology, and to stimulate private sector investment in energy innovations.

Technology policy objectives are certain – to support and motivate R&D that provides society with the capacity to respond to climate change, and to reduce the cost of achieving stabilization targets. Appropriate policy instruments, public-private roles, and coordinating structures remain to be determined, but a few things are apparent.

Broad commitment is necessary because no simple solutions exist. Innovations will arise from improved scientific knowledge and technical advances in traditional, new, and yet-to-be-discovered fields of inquiry. They also will emerge through developmental work in promising areas such as carbon capture and storage, hydrogen, nuclear power, end-use efficiency, superconductivity, renewables, and fuel cell technology. Some innovations may have high value for reducing domestic emissions, while others may offer significant export potential, finding widespread use elsewhere. Across-the-board investment is critical because only a robust technology portfolio of low- and non-emitting options will ensure that ample, affordable supplies of energy can be made globally available in a manner consistent with climate policy goals.

Substantial new investment is required because domestic and global expenditures on energy R&D have been falling for more than two decades, and current spending levels on technologies with long-term promise are inadequate. Not only are overall energy R&D expenditures declining, but also the fraction of the global effort devoted to long-term, basic energy research is shrinking. The private sector has increasingly focused on immediate priorities shaped by competitive pressures, while the U.S. government's emphasis on R&D collaboration has diverted resources toward near-term, more applied work favored by industry partners.

Sustained commitment and funding is necessary because new energy technologies have very long lead times for R&D, commercial introduction, and widespread use. Dramatic advances will not occur overnight. Decades will be required to prove, improve, and then deploy advanced options capable of delivering steep emissions reductions around the world at an acceptable cost in the latter-half of the 21st century (or earlier if necessary).

The potential benefits of increasing the annual public-private outlay for energy R&D will dwarf the costs incurred by society. Investments that accelerate the energy transition will pay for themselves by orders of magnitude, delivering needed reductions at a cost savings of trillions of dollars for global society.

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Public-Private Commitments

For broad, substantial, and sustained R&D investment to occur, climate technology policy must establish a consistent, long-term source of public funding, as well as create incentives that increase private sector expenditures.

Reversing recent trends poses major challenges. In the United States and other developed nations, energy-related R&D expenditures have been declining despite increasing prosperity; growing overall R&D budgets; and expanding awareness of the geopolitical, environmental, and social implications of energy supply and use. In both the public and private sectors, the intergenerational nature of the climate challenge works against it. Long-term issues seldom receive precedence among so many competing needs, while energy-related R&D priorities tend to change in response to shifting political and economic conditions.

To ensure a consistent stream of public funding, a dedicated revenue source may be required. Numerous possible mechanisms exist. Regardless of the chosen policy approach, past experience demonstrates that public support for basic scientific work and for precommercial R&D yields substantial returns. Historic advances in end-use efficiency, nuclear power, renewables, and other key energy technologies have been the by-products of government-funded programs. Future innovations will arise through public R&D investments in these areas and in emerging technologies. The energy transition will also be fueled by fundamental and precompetitive research in materials, fuels, bioengineering, nanotechnology, and other disciplines – the clear domain of public funding.

Incentives for increasing near-term private sector investment in the energy transition also must be created because efficient near-term price signals—and the potential for stringent constraints to be imposed at some point in the future—will not be sufficient. The challenges are to motivate corporations, institutions, and other organizations to spend on long-term energy R&D and to coordinate these investments with other publicly funded ones without mandating their direction. Grants, tax incentives, prizes, and public-private consortia are among the many possible policy instruments that may prove helpful.

Climate technology policy extends beyond supporting and motivating R&D. When public-private work succeeds, innovations still must be rapidly and widely deployed for technology to fulfill its role in reducing the costs of achieving climate stabilization targets. Support mechanisms used in the past to accelerate deployment of advanced energy technologies include loan guarantees, cost-sharing arrangements, investment and production tax credits, and other fiscal incentives.

Other possible enabling policy instruments exist for encouraging deployment of lower-emitting technologies, including carbon pricing. To control overall policy costs, price signals should be employed that reflect the fundamental, long-term nature of this issue, ensuring emissions reductions are made where and when they are least expensive.

Question 2. Allocation
Submitter's Name/Affiliation: Richels & Wilson/EPRI

Clarifying Questions 2d:

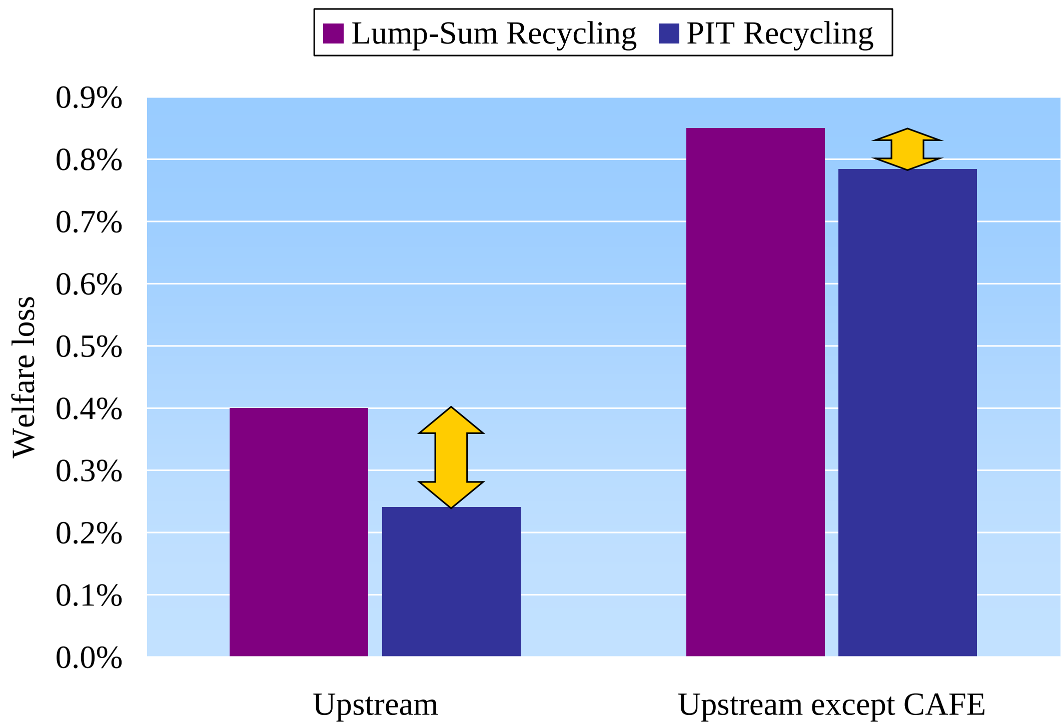
Set-Aside Programs

- What portion of the allocation pool should be reserved for the early reduction credit program and the offset pilot program?
- Are other set-aside programs needed?

As noted in several of our other responses, an economically-efficient program will have broad coverage of emission sources and greenhouse gases. Many of the domestic emission reduction opportunities that are traditionally thought of as offsets could be part of the regulated system. Therefore, under an economically efficient approach, there will be relatively few domestic opportunities for reductions outside the system.

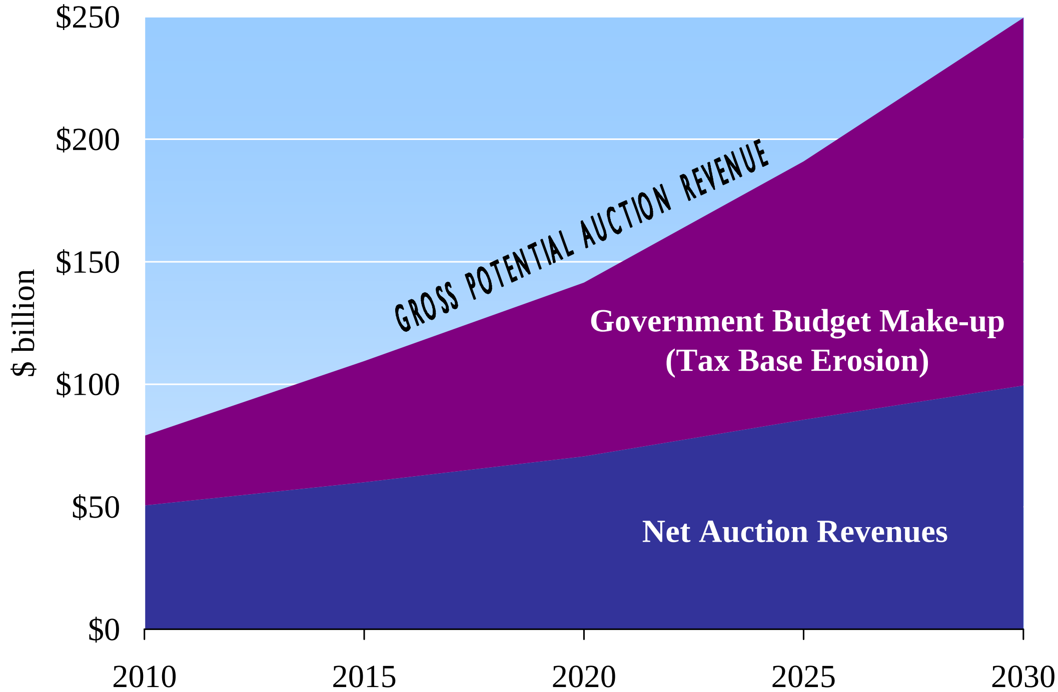
On the other hand, a critically important element of controlling costs of a domestic policy and for encouraging coordinated international activity is the inclusion of international offsets. The United States, as the buyer of offsets, can control their environmental quality – these reductions should be real reductions. Therefore, there appears to be no need to set aside a portion of the allocation pool to accommodate them.

Figure A2-1. Estimates of the potential benefits of revenue recycling through reductions in marginal U.S. personal income tax (PIT) rates for two domestic climate policy approaches that limit CO2 emissions to 2000 levels. The potential benefits of revenue recycling (denoted by the arrows) are significantly larger in the upstream regulation case, primarily because there is less slowing of the economy and consequently less erosion of the Federal tax base that must be addressed (see Figure A2-2). As is pointed out later in this discussion, it is very unlikely that these potential recycling benefits will be realized.



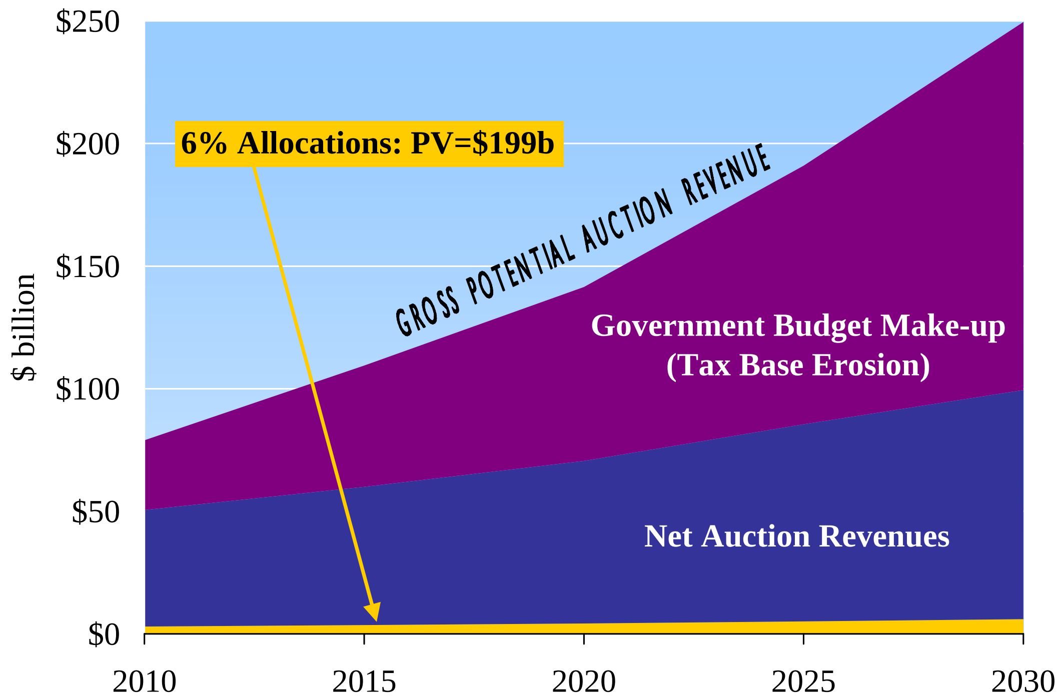
Source: Smith, A. and M. Ross, 2002: Allowance allocation: Who wins and loses under a carbon dioxide control program? Working paper prepared for the Center for Clean Air Policy.

Figure A2-2. Estimates of gross revenue and net revenue (with erosion of the overall tax base) in the U.S. for a policy that limits developed countries to 2000-level emissions.



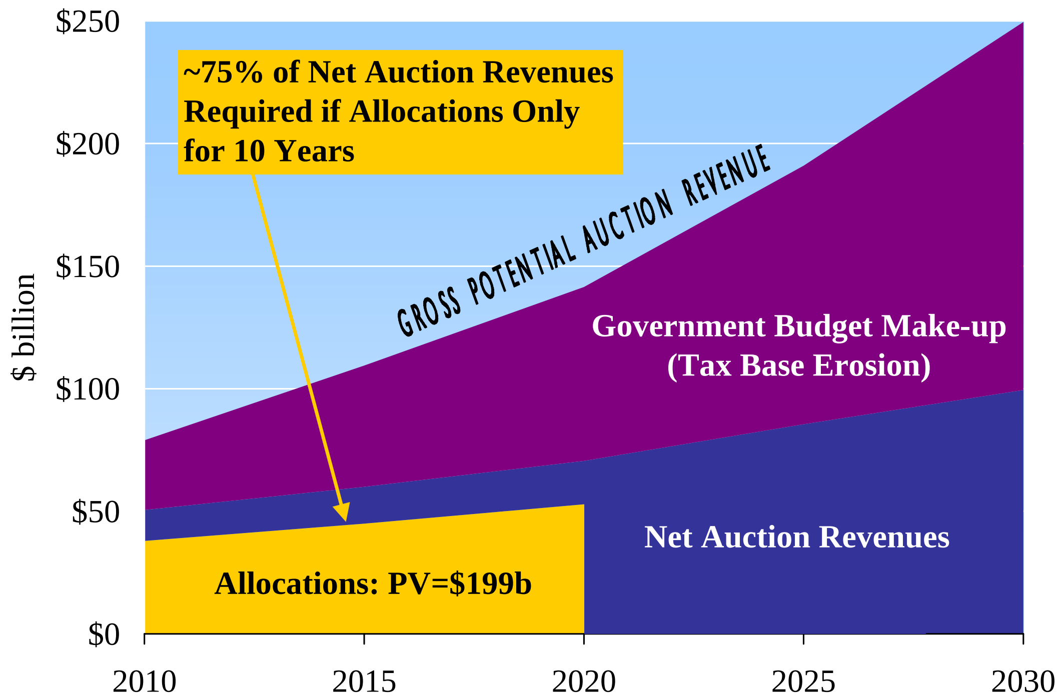
Source: Ross, M. and A. Smith, 2002: Implications of trading implementation design for equity efficiency trade-offs in carbon permit allocations. Working paper, Charles River Associates.

Figure A2-3. Perpetual allocations to compensate energy industries.



Source: Ross, M. and A. Smith, 2002: Implications of trading implementation design for equity efficiency trade-offs in carbon permit allocations. Working paper, Charles River Associates.

Figure A2-4. Ten years of allocations to compensate energy industries.



Source: Ross, M. and A. Smith, 2002: Implications of trading implementation design for equity efficiency trade-offs in carbon permit allocations. Working paper, Charles River Associates.

Question 3. International Linkage
Submitter's Name/Affiliation: Richels & Wilson/EPRI

Should a U.S. system be designed to eventually allow for trading with other greenhouse gas cap-and-trade systems being put in place around the world, such as the Canadian Large Final Emitter system or the European Union emissions trading system?

Climate change is a global issue. The potential benefits of integrating a U.S. trading system with other climate policies, being implemented around the world, are huge – it fosters engagement and cooperation with other countries, it can potentially provide substantial savings in policy cost, and it does not weaken the environmental integrity of a program. Our response in this section highlights our research on the value of international trade.

The gains from international "where" flexibility can be quite large. Numerous studies have shown that global mitigation costs can be reduced substantially by allowing emission reductions to take place wherever it is cheapest to do so, regardless of geographical location. To date, most studies have focused on the Kyoto Protocol, but the results are qualitatively applicable to any approach involving multi-country reductions. The study reviewed here provides an example of the benefits of international trade in carbon emission rights.

The Kyoto Protocol includes several provisions allowing for a limited amount of "where" flexibility. These include emission trading and Joint Implementation (JI) among Annex I countries (OECD and Eastern Europe), as well as a Clean Development Mechanism (CDM) intended to facilitate cooperative emission reduction projects between Annex I and non-Annex I (developing) countries.

One study[1] compared the cost of three scenarios: 1) no international trading, 2) Annex I trading plus CDM, and 3) full global trading. Figure A3-1 in Appendix 3 illustrates the price of carbon emission rights to the United States in 2010 and 2020. In the most constrained scenario (no trading), the United States must satisfy its emission reduction requirements within its own boundaries. In this case, the price approaches $240 per ton of carbon[2] in 2010. In the Annex I plus CDM case, the value drops to slightly less than $100 per ton in 2010. As might be expected, the value of emission rights is lowest with full global trading, falling to $70 per ton in 2010. As the competition for emission rights increases, the price rises.

[1] Manne, A. and R. Richels, 1999: The Kyoto Protocol: A cost-effective strategy for meeting environmental objectives? *The Energy Journal*, special issue (May), 1-23.

[2] Some studies present costs of abatement in dollars per ton of carbon ($/ton C), others in dollars per ton of CO2 ($/ton CO2). Some use metric tons (tonnes) and others use short tons. To convert the figures presented in this response to $/ton CO2, divide by approximately four (e.g., $240/ton C is equivalent to $60/ton CO2).

Question 3. International Linkage
Submitter's Name/Affiliation: Richels & Wilson/EPRI

Clarifying Question 3a:

- Do the potential benefits of leaving the door open to linkage outweigh the potential difficulties?

The magnitude of the benefits would depend, of course, on the constraint. However, the example discussed on the previous page provides some insight into the size of the potential benefits. One way to view the costs of abatement is to show losses in terms of gross domestic product (GDP). Figure A3-2 in Appendix 3 displays the results of the analysis for the United States.[3] Losses are higher in the absence of trading, approaching $90 billion in 2010. This is approximately one percent of U.S. GDP. To the extent that trade is introduced, losses decline. Under the most optimistic option (full global trading), losses are approximately $20 billion in 2010. Again, the costs to the U.S. economy increase over time as the competition for emission rights bids up their price.

From Figure A3-2, it is clear that action to limit full where flexibility can entail significant economic costs. This could occur either through limiting the amount of offsets that a country can purchase or by international agreements which exclude some major emitters.

Also, we note that expanding the number of countries participating in an agreement will reduce overall costs, but the individual member costs may go up or down depending upon their relative costs of reductions.

Potential difficulties relate to increased complexity—due to additional regulations needed to implement linkage—and environmental integrity. Since the United States can unilaterally control what purchases are allowable, these environmental integrity issues can be limited. The long-term benefits of international trade, which measure in tens of billions of dollars as noted above, far outweigh these potential short-term difficulties.

[3] Manne, A. and R. Richels, 1999: The Kyoto Protocol: A cost-effective strategy for meeting environmental objectives? *The Energy Journal*, special issue (May), 1-23.

Question 3. International Linkage
Submitter's Name/Affiliation: Richels & Wilson/EPRI

Clarifying Question 3b:

- If linkage is desirable, what would be the process for deciding whether and how to link to systems in other countries?

Linkage can be one way, allowing United States entities to use allowances from other systems to count towards compliance; or two-way, providing a full linkage with another trading system. The U.S. can unilaterally control the importation of emissions allowances, thereby controlling their quality. The principal issues will be 1) maintaining environmental integrity (e.g., by linking to systems with comparable monitoring and verification, similar "safety valves", etc.), and 2) minimizing additional transaction costs. There are a large number of details to consider in linking, which have been addressed in detail in a paper jointly developed by EPRI, the International Energy Agency, and the International Emissions Trading Association.[4]

Much can be learned from studying existing systems. For example, in a study[5] of the European Union Emissions Trading Scheme (EU-ETS),[6] the Electric Power Research Institute found that the development of the EU-ETS and its operation to date can provide useful insights for stakeholders that may be involved in the design of any future national or regional greenhouse gas (GHG) emissions trading program. These insights include:

- **Provide clarity, consistency, and adequate lead-time.** Policy makers can reduce market uncertainty and improve functioning of a new GHG emissions trading system by providing adequate lead time for firms to prepare for the start of the program, providing clarity about future regulatory requirements, avoiding different rules across jurisdictions, and making key policy decisions at the beginning of the program.
- **Cover all sectors and gases.** To maximize economic efficiency, increase available GHG abatement options, and reduce compliance costs, a GHG emissions trading program should include broad coverage of economic sectors and greenhouse gases.
- **Include compliance flexibility.** Allowing regulated firms to achieve compliance using "flexible" mechanisms, like GHG emissions reduction "credits" created by the Kyoto Protocol's Clean Development Mechanism (CDM) and Joint Implementation (JI) programs, can increase available GHG abatement options and reduce compliance costs.
- **Allow inter-temporal banking and borrowing.** "Banking" and "borrowing" of emissions allowances between compliance periods can provide market incentives for "over-compliance", and can help firms to optimize their operations over the entire time horizon of the trading program.

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[4] Haites, E. and F. Mullins, 2001: Linking domestic and industry greenhouse gas emission trading systems. Report prepared for EPRI, the International Energy Agency (IEA), and the International Emissions Trading Association by Margaree Consultants.

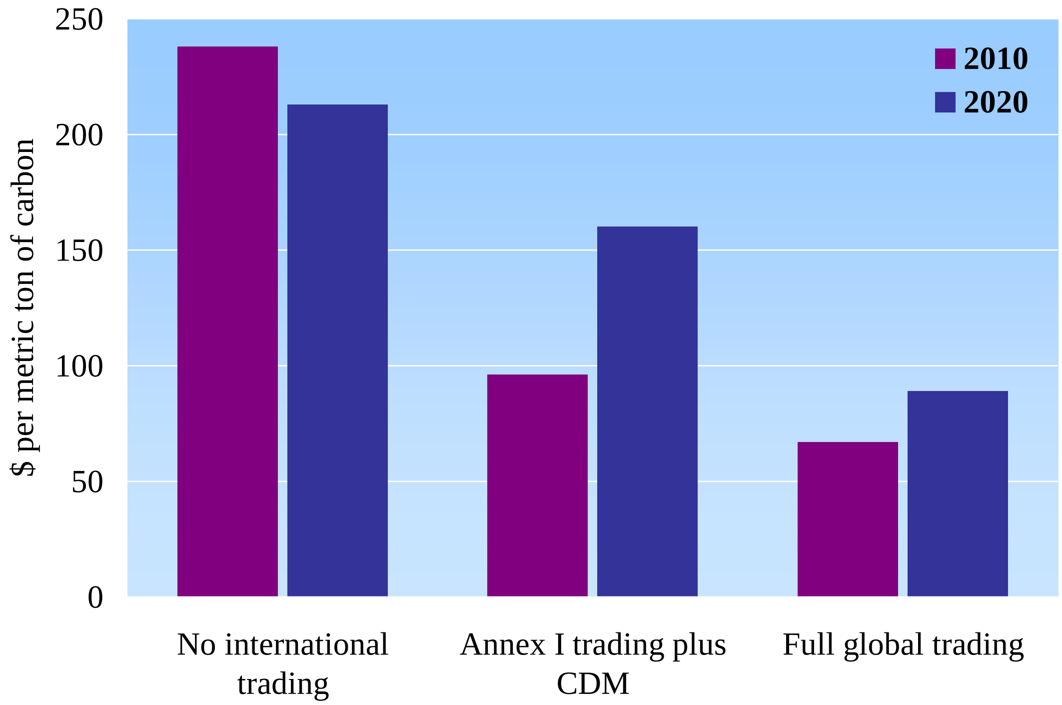
[5] EPRI (Electric Power Research Institute), 2004: The EU emissions trading scheme: Key issues and future outlook. *Technical Update*, **1009924**, December.

[6] European Commission, 2004: *EU Emissions Trading: An Open Scheme Promoting Global Innovation to Combat Climate Change*. http://europa.eu.int/comm/environment/ climat/pdf/emission_trading2_en.pdf.

Question 3. International Linkage
Submitter's Name/Affiliation: Richels & Wilson/EPRI

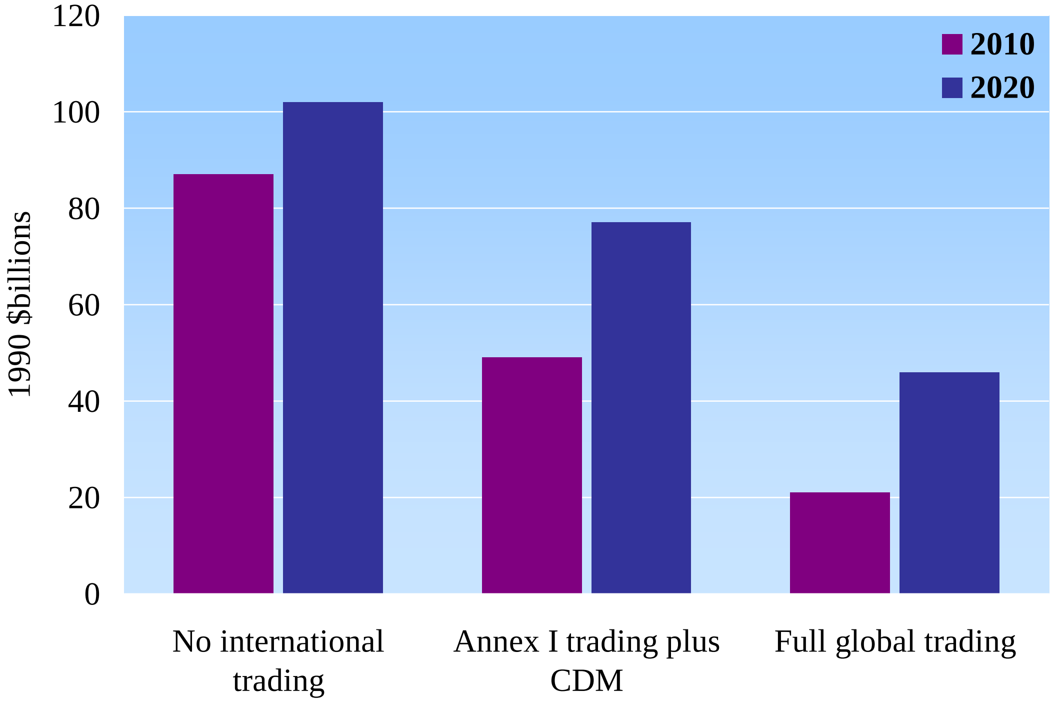
- **Encourage linking.** Linking emissions trading programs to similar programs in other nations and regions, and allowing different kinds of "credits" to be used for compliance purposes, can increase the benefits of emissions trading, but also may require a variety of difficult market design issues to be addressed.
- **Carefully consider incentives that allocations create.** Several EU countries adopted rules that disallow companies from re-allocating EU emission allowances granted to older, less efficient installations that are closed and replaced by new, more efficient ones. This approach should be avoided as it discourages companies from replacing older plants.

Figure A3-1. Incremental value of carbon emission rights in the United States under alternative scenarios for implementation of the Kyoto Protocol.



Source: Manne, A. and R. Richels, 1999: The Kyoto Protocol: A cost-effective strategy for meeting environmental objectives? *The Energy Journal*, special issue (May), 1-23.

Figure A3-2. Annual U.S. GDP losses under alternative scenarios for implementation of the Kyoto Protocol.



Source: Manne, A. and R. Richels, 1999: The Kyoto Protocol: A cost-effective strategy for meeting environmental objectives? *The Energy Journal*, special issue (May), 1-23.

Question 4. Developing Country Participation
Submitter's Name/Affiliation: Richels & Wilson/EPRI

If a key element of the proposed U.S. system is to 'encourage comparable action by other nations that are major trading partners and key contributors to global emissions,' should the design concepts in the NCEP plan (i.e., to take some action and then make further steps contingent on a review of what these other nations do) be part of a mandatory market-based program? If so, how?

The sequencing of country participation is both a strategic decision and one of equity. However, it is clear that the stabilization of emissions, much less atmospheric concentrations, cannot occur without substantial participation by developing countries.

International negotiations aimed at stabilizing atmospheric carbon dioxide levels have focused mainly on near-term actions in developed countries. However, developing countries need to play a significant role because: 1) developing countries will account for the major share of anthropogenic emissions over the current century, 2) developing countries provide opportunities for cost-effective emission reductions, and 3) exclusion of developing countries can result in significant migration of carbon-intensive industries to developing countries and, hence, can dilute the efforts of developed countries.

In 1990, countries of the Organization of Economic Cooperation (OECD), the former Soviet Union, and Central and Eastern Europe accounted for about two-thirds of anthropogenic emissions. Under the Kyoto Protocol, these countries (referred to as Annex I) are called upon to adopt emission constraints for the early decades of the 21st century. As shown in Figure A4-1 in Appendix 4,[1] developed countries cannot deal with climate change alone.[2] Over the present century, developing countries will take on an increasingly larger share of carbon emissions due to population growth and economic development.

Even if Annex I countries agreed to completely eliminate their emissions, developing countries would have to make substantial reductions in order to stabilize atmospheric CO_2 concentrations. The extent of the reductions depends on the selected atmospheric stabilization level.

Question 3 explored the value of "where" flexibility – allowing emission reductions to take place where it is cheapest to do so regardless of their geographical location. Figure A4-2 shows

[1] Studies typically present quantities of CO_2 in either "tons of CO_2" or in "tonnes (metric tons) of carbon". Our responses present results in the same units as the source material from which they are drawn. To convert from tonnes of carbon to tons of CO_2, multiply by about four (e.g., global emissions of 6 billion tonnes of carbon are equivalent to 24 billion tons of CO_2). Conversely, to convert \$/tonne of C to \$/ton of CO_2, you divide by four (e.g., \$240/tonne C is roughly equivalent to \$60/ton of CO_2).

[2] Manne, A. and R. Richels, 1997: Toward the stabilization of CO_2 concentrations – Cost-effective emission reduction strategies. Presented at the *IPCC Asia-Pacific Workshop on Integrated Assessment Models*, United Nations University, Tokyo, Japan, March 10-12.

the marginal costs of emission reductions under one allocation of global emission rights.[3] Here, developing country emissions are allowed some room for growth before they must enter into a reduction program. Relative to the average for Annex I countries, the marginal costs for developing countries included in the analysis are substantially lower. Reductions in China, for example, could be achieved at one-fourth the cost of reductions in Annex I countries.

"Spillover" effects involve the location of carbon intensive industries. A constraint on Annex I emissions will reduce their competitiveness in the international marketplace. Studies reviewed by the IPCC suggest that there will be some industrial relocation offshore, with non-Annex I countries benefiting at the expense of Annex I countries. According to the IPCC, leakage can occur along a number of channels, including:

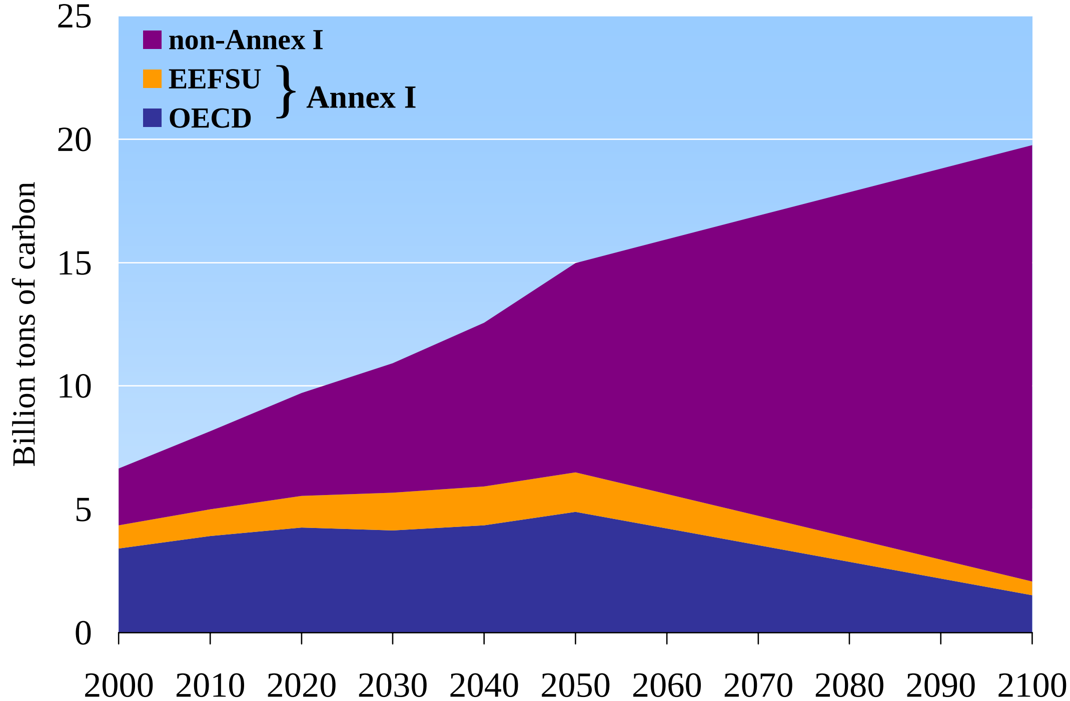
- The relocation of the production of energy-intensive products to non-abating regions.
- Energy market effects, including increased energy consumption in non-abating regions and interfuel substitution between fuels of differing carbon contents, due to the differential decline in fossil fuel prices in response to reduced demand in abating regions.
- Changes in regional incomes (and thus energy demand) due to terms of trade changes.

Estimates of the magnitude of the leakage problem vary, however, it should be noted that the IPCC finds a potential for substantial dilution of abatement efforts in developed countries by non-abating countries – in some cases exceeding 70%.[4]

[3] Montgomery, W.D., 1996: Differentiation of national circumstances and options for future commitments. Presentation to the Ad Hoc Group on the Berlin Mandate (AGBM 5), Geneva, Switzerland, December 11.

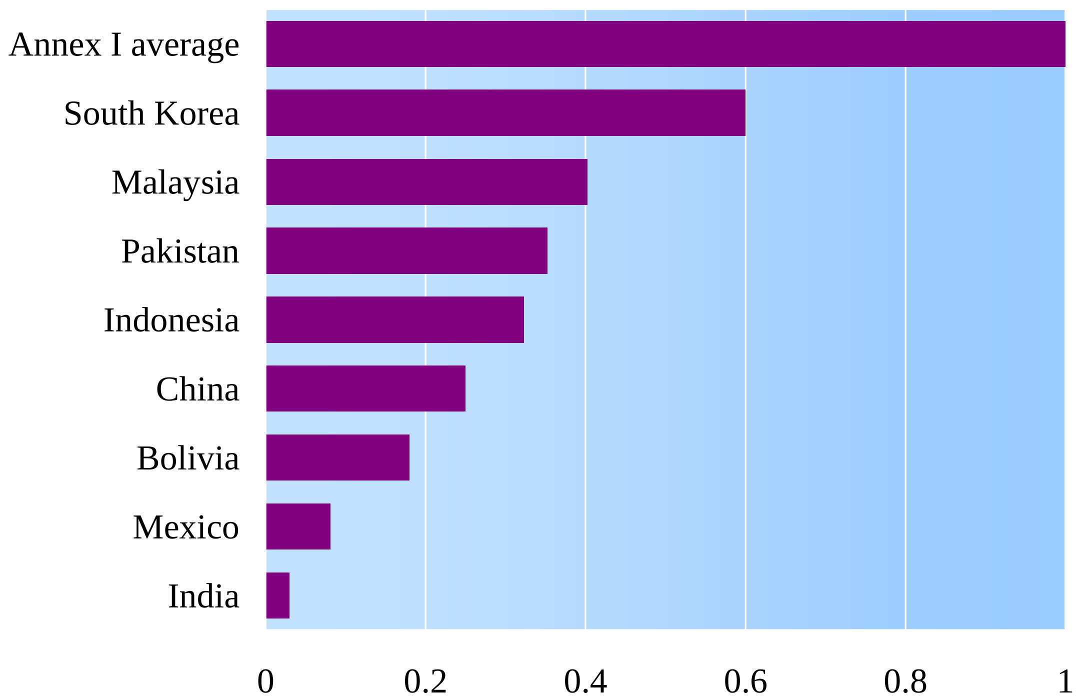
[4] IPCC (Intergovernmental Panel on Climate Change), 1996: *Climate Change 1995 – Economic and Social Dimensions of Climate Change*. Cambridge University Press, UK.

Figure A4-1. Projected carbon emissions in the developed "Annex I" countries (OECD and EEFSU – Eastern Europe and the former Soviet Union) and developing, non-Annex I countries (China and the rest of the world) in the absence of CO2 limitations.



Source: Manne, A. and R. Richels, 1997: Toward the stabilization of CO2 concentrations – Cost-effective emission reduction strategies. Presented at the *IPCC Asia-Pacific Workshop on Integrated Assessment Models*, United Nations University, Tokyo, Japan, March 10-12.

Figure A4-2. Relative marginal costs of emission reductions in different countries.



Source: Montgomery, W.D., 1996: Differentiation of national circumstances and options for future commitments. Presentation to the Ad Hoc Group on the Berlin Mandate (AGBM 5), Geneva, Switzerland, December 11.

National Commission on Energy Policy

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Provide an executive summary of your response(s). ***Do not exceed the remainder of this page.***

Principles for Allocation

Because overall program costs and effectiveness are largely unaffected by who gets free allowances at the outset, allocation decisions can be used to address equity concerns and (potentially) to advance other policy objectives. A firm that receives free allowances has effectively received an upfront, lump-sum payment. This payment can be used to offset the economic burden of the policy without reducing the firm's motivation to reduce future emissions. As described in our full submission, the real societal costs imposed under a tradable permits program for greenhouse gases such as the Commission has proposed are, by design, quite small in the context of the overall economy. Nevertheless those costs will impose differential burdens on different stakeholders throughout the economy and, as a result of the trade in allowances that will occur under the policy, engender somewhat larger transfers of wealth. In the context of these uneven burdens, how allowances are distributed to different stakeholders in the initial allocation will have important impacts on the perceived fairness of the policy.

Therefore, the Commission continues to recommend, as it did in its 2004 report, that Congress allocate permits in a way that recognizes the disparate burdens created by greenhouse gas regulation. This means that entities should not receive free allowances in excess of the amount required to compensate them for their actual profit losses under the proposed program. It also means that downstream energy users (including energy-intensive industries as well as households), who—according to available economic analyses—can expect to bear a substantial share of the burden of the policy, should not be excluded from the allocation merely because they are not being directly regulated (in the sense of being required to submit allowances).

In fact, economic analyses based on EIA data indicate that the actual burden imposed on upstream fossil fuel producers is small under a policy such as the one proposed by the Commission, regardless of whether they are the entities regulated. Specifically, these analyses suggest that fully compensating fuel producers for their profit losses under the program would require only about 10 percent of available allowances, leaving roughly 90 percent of the allocation available for distribution to energy users further downstream. The White Paper recently issued by Senators Domenici and Bingaman identifies a number of constituencies and purposes that could be included in the allocation. The Commission agrees that all of these should be considered when allocating available allowances and, though not in a position to offer specific recommendations on what share should go to each, urges Congress to maximize the benefits achieved through allocation by avoiding allocation formulae that, by overcompensating some interests (and thereby effectively awarding them windfall profits), diminish the opportunity to advance equity and other important policy goals.

Question 2. Allocation
Submitter's Name/Affiliation: Jason Grumet / NCEP

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

Principles of Allocation

Introduction and Context

In December 2004, the bipartisan National Commission on Energy Policy released a report outlining a comprehensive set of recommendations for national energy policy. A prominent element of that proposal was its recommendation that the United States implement a mandatory, economy-wide cap-and-trade permits program to limit greenhouse gas emissions. Since issuing its initial report, the Commission has become even more convinced that mandatory action to address the U.S. contribution to climate change risks is scientifically justified and essential to sound long-term energy policy, and that it can be accomplished in a manner that does not harm the U.S. economy or the competitiveness of U.S. businesses. A mandatory reduction program is also critical in positioning the U.S. as part of the global community in addressing greenhouse gas emissions.

The Commission therefore strongly supports recent steps taken by the U.S. Senate toward developing an effective policy response to energy-related climate risks, starting with the resolution adopted in June, 2005 expressing "the sense of the Senate that Congress should enact a comprehensive and effective national program of mandatory, market-based limits and incentives on emissions of greenhouse gases that slow, stop, and reverse the growth of such emissions at a rate and in a manner that (1) will not significantly harm the United States economy; and (2) will encourage comparable action by other nations that are major trading partners and key contributors to global emissions."

In its 2004 report, the Commission described the basic architecture of a program that it believes would meet these core criteria by creating an effective market signal for reducing greenhouse gas emissions while imposing minimal costs on the U.S. economy and linking U.S. actions to global reduction efforts. In this document, the Commission offers its further views concerning the allocation of emissions permits or allowances in the context of a mandatory, economy-wide, greenhouse-gas trading program modeled on its recommendations.[1]

Understanding Allocation

In earlier emissions trading programs—most notably the U.S. Acid Rain program and later NOx trading programs implemented by the eastern states—the great majority of free allowances have simply been allocated to entities directly regulated under the program (in both

[1] In its 2004 report, NCEP noted that allocation issues were likely to be contentious and urged Congress to "allocate permits in a manner that recognizes the disparate burdens created by greenhouse gas regulation" while also directing specific attention "toward addressing impacts on low-income and minority households" (NCEP, *Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges*, 2004, pp. 28–29).

cases primarily electric utilities), generally in proportion to their historic fuel consumption or emissions, and generally through an allocation approach that does not change over time. The Commission's own analysis and questions posed in the White Paper recently issued by Senators Domenici and Bingaman suggest that several factors are likely to argue for a different approach when seeking to limit economy-wide greenhouse gas emissions. First, the sum value of the permits or allowances to be allocated (estimated to average from $30 to $40 billion per year, under the Commission's proposal) is far higher than in past programs (for example, the total value of SO_2 allowances allocated under the Acid Rain program is on the order of $1-2 billion per year). Second and more important, economic analyses indicate that the distribution of costs imposed under a broad-based greenhouse gas trading program will be much more varied than in previous emissions trading programs that were largely limited to one sector of the economy. As a consequence, the distributional and equity issues involved are also more complex, and merit innovative approaches to allocation as a means of addressing them.

Two crucial points about cost must be stressed at this juncture. First, the cost to society of implementing a trading program to limit emissions is equal to the cost of the mitigation measures undertaken as a result of that program. This real societal cost (estimated to average roughly $4 billion per year under the NCEP proposal) is far less than the value of the allowances that are created by governmental action and that change hands under the trading program; such allowance transactions represent a transfer of wealth between firms but do not reflect a net cost to society. *It cannot be emphasized enough that the overall cost of the NCEP proposal and its estimated impact on the future growth of the U.S. economy are very small* (on the order of a few tenths of a percent of the more than 60 percent increase in overall GDP expected to occur over the next 15 years). So while the overall economic cost of adopting the program is small, the large value of allowances created offers an opportunity to mitigate disproportionate impacts on various adversely affected parties.

A related and equally crucial second point is that the real economic burden imposed on individual firms or sectors as a consequence of the proposed trading program is not necessarily proportionate to the amount of allowances firms or sectors must surrender as a result of their direct or imputed greenhouse gas emissions. Rather the burden imposed on different firms depends to a great extent on a firm's ability to pass through compliance costs as part of the good provided or service rendered. In an upstream system where fossil fuel producers or suppliers are required to submit allowances, economic theory and recent analysis indicates that most allowance costs will be passed through to downstream energy users[2]—accordingly, many of the entities that are directly regulated can expect to bear only a relatively small fraction of the program's real cost despite, in some cases, being required to submit large volumes of allowances.[3]

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[2] According to economic theory, the extent to which costs are passed through to consumers depends upon producers' ability to raise prices without reducing demand for the product. For a recent analysis of the distributional impacts of a tradable permits program, see Bovenberg, A Lans and Lawarence H. Goulder. "Neutralizing the Adverse Impacts of CO2 Abatement Policies: What Does It Cost?" in C. Carraro and G. Metcalf, eds., *Behavioral and Distributional Effects of Environmental Policies*, University of Chicago Press, 2001.

[3] In fact, some fuel suppliers could actually experience a net increase in profits under the policy. Natural gas producers or pipeline operators, for example, could benefit from increased sales under a greenhouse gas trading program, despite having to charge higher prices for each unit of gas sold to cover their allowance costs.

Question 2. Allocation
Submitter's Name/Affiliation: Jason Grumet / NCEP

Indeed, one of the advantages of an emissions-trading program is that it separates distributional issues from efficiency issues. Efficiency requires that all emitters face the same price per carbon-equivalent ton of emissions at the margin. Permits or allowances can be allocated any number of ways, but as long as each additional ton of emissions involves paying the market price of an allowance, emitters will have an incentive to emit the efficient amount. If a firm receives an allocation less than its total emissions, it faces directly paying the market price for the additional allowances it needs to cover those emissions. But even a firm whose freely distributed allocation *exceeds* its total emissions can—by reducing emissions—increase the number of excess permits it has available to sell at the market price. In either case, the firm has the proper incentive to reduce emissions. A consequence of this important feature of a trading program is that allocation decisions, according to economic theory, should have no impact on incentives, on the amount of emissions reductions achieved as a result of the policy, on where the emissions reductions occur, or on who bears the cost of implementing them.

One very important caveat to this general rule involves allocations to regulated utilities. Regulated utilities that receive free allowances may be prevented by state regulators from keeping any profits generated by selling unused allowances and/or from passing the opportunity cost associated with each ton of emissions through to customers. In this instance, allocation decisions can have an impact on incentives and can affect the way the program functions by distorting the price signal. Even so, on the margin, the incentives for even the regulated utility are consistent with theory—an increase in emissions means the utility will either incur the market price of additional allowances or forego the revenue that could be generated by selling additional allowances into the market.

<u>Principles for Allocation</u>

Because incentives going forward are unaffected by who gets free allowances at the outset, allocation decisions can be used to address equity concerns and (potentially) to advance other policy objectives. A firm that receives free allowances has effectively received an upfront, lump-sum payment. This payment can be used to offset the economic burden of the policy without reducing the firm's motivation to reduce future emissions.[4] As noted previously, the real societal costs imposed under a program such as the Commission has proposed are, by design, quite small in the context of the overall economy. Nevertheless those costs will impose differential burdens on different stakeholders throughout the economy and, as a result of the trade in allowances that will occur under the policy, engender somewhat larger transfers of wealth. In the context of these uneven burdens, how allowances are distributed to different stakeholders in the initial allocation will have important impacts on the perceived fairness of the policy.

Therefore, the Commission continues to recommend, as it did in its 2004 report, that Congress allocate permits in a way that recognizes the disparate burdens created by greenhouse gas regulation. This means that entities should not receive free allowances in excess of the amount required to compensate them for their actual profit losses under the proposed program. It also means that downstream energy users (including energy-intensive industries as well as households), who—according to available economic analyses—can expect to bear a substantial

[4] As noted above, however, a free allocation to regulated utilities could distort price signals and affect a firm or consumer's incentives to reduce emissions.

share of the burden of the policy, should not be excluded from the allocation merely because they are not being directly regulated (in the sense of being required to submit allowances).

In fact, economic analyses based on EIA data indicate that the actual burden imposed on upstream fossil fuel producers is small under a policy such as the one proposed by the Commission, regardless of whether they are the entities regulated. Specifically, these analyses suggest that fully compensating fuel producers for their profit losses under the program would require only about 10 percent of available allowances, leaving roughly 90 percent of the allocation available for distribution to energy users further downstream. The White Paper recently issued by Senators Domenici and Bingaman identifies a number of constituencies and purposes that could be included in the allocation. The Commission agrees that all of these should be considered when allocating available allowances and, though not in a position to offer specific recommendations on what share should go to each, urges Congress to maximize the benefits achieved through allocation by avoiding allocation formulae that, by overcompensating some interests (and thereby effectively awarding them windfall profits), diminish the opportunity to advance equity and other important policy goals.

Ultimately, there is no approach to allocation that can hold harmless all stakeholders or render entirely costless a policy for reducing greenhouse gas emissions. Nevertheless, allocation can play an important role in addressing equity and welfare concerns that are likely to attend the introduction of such a policy. Allocation decisions will inevitably be contentious and will draw competing claims from different stakeholders. As they weigh these claims, policymakers should apply consistent guidelines and keep in mind that allocation is a zero-sum game. Since the total quantity of allowances available for free allocation is fixed, giving more allowances to one sector or entity necessarily means that fewer allowances are available for others.

Allocation to Households and Low-Income Families

While the Commission believes that only Congress is capable of reconciling competing demands on that portion of the allocation that is not needed to compensate regulated entities, NCEP has concluded that addressing the needs of low-income Americans should be part of the equation. Our review of EIA's economic analysis for Senator Bingaman indicates a large share (at least one-third) of allowance costs will ultimately be passed through to households. Households may face additional, indirect costs as businesses also pass through higher energy-related costs for goods and services. Accordingly, the Commission supports using a portion of the allocation to offset costs to households generally, and low-income households in particular. Some mechanism would need to exist to convert allowances to revenues that could be directed to households, either via broad-based rebates or tax reform, or via targeted programs like the Low-Income Home Energy Assistance Program (LIHEAP), weatherization assistance, or a combination of both.

NJ Board of Public Utilities

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The New Jersey Board of Public Utilities ("NJBPU") commends the U.S. Senate and this Committee for seeking effective and affordable solutions to global climate change and, specifically, for recognizing that a federal system of mandatory limits aimed at slowing – and then reducing – emissions from fossil fuels is a key step in responding to the dangers of global warming. By leading the nation in examining the international problem of greenhouse gas emissions, the U.S. Senate is recognizing a crucial fact: The problem of greenhouse gas emissions is best addressed at a federal level. This has proven true not only with regard to global warming, but also, for example, with the U.S. Department of Energy's successful mandatory acid rain controls.

The NJBPU thanks the Committee for allowing it to submit these comments. Because of our expertise both as a regulator of the electric industry and as a founding member of the Regional Greenhouse Gas Initiative ("RGGI"), our comments focus on allocation approaches for carbon dioxide allowances in a "cap-and-trade" program for electric generators. Although our comments may overlap with various topics discussed in the clarifying questions, our response is meant as a general response only to Question 2. The NJBPU's comments are summarized below:

- The cost of complying with a carbon constraint will increase the cost of wholesale power, since fossil-fired units are typically the marginal unit. In a market-based structure, this increase in wholesale power prices will increase revenue for all generators, even those that are not subject to the cap-and-trade program.

- Allocating all allowances to generators will not reduce the aggregate cost of complying with a carbon constraint, nor will it save electricity ratepayers money. In a competitive market, generators subject to a cap-and-trade program factor in the cost of grandfathered (free) allowances into their bid price, since these allowances have a value and can be sold in the allowance market. The decision to generate would use up allowances, and therefore imposes an "opportunity cost"; allowances that are expended cannot be sold in the market and therefore potential revenue is lost. As a result, grandfathering of allowances does not result in lower electricity prices relative to other allocation mechanisms.

- Because of the above facts, a public benefits allocation can reduce the aggregate cost of complying with a carbon cap, and increase program effectiveness by providing unprecedented integration of support for end-use energy efficiency into a generator-focused cap-and-trade program. This would facilitate integration of supply-side and demand-side efforts to address the reduction of carbon emissions through a comprehensive, least-cost approach, without requiring utility ratepayers to bear the cost of increased funding for energy efficiency programs. Recycling allowance revenue into programs that reduce electricity load growth will result in greater emissions reduction benefits achieved at lower cost, thereby reducing the impact on electricity customers.

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

In Support of a Public Benefits Allocation
Due to the nature of CO_2 and other greenhouse gases as pollutants and the lack of commercially available end-of-stack controls, integrating improvement in end-use energy efficiency into a generator-focused cap-and-trade program is critical to program success. The significant differences of a carbon cap-and-trade program compared to programs designed in the context of commercially available end-of-stack pollution controls (Acid Rain Program and NO_x Budget Program) argue for a new approach to allocating allowances.

Historically, cap-and-trade programs have given allowances to electric generators for free, a practice commonly referred to as "grandfathering".[1] We propose that allowance revenue should be managed in the public trust through a "public benefits", or "consumer" allocation. Through such a mechanism, allowances would be allocated to a third party, such as load-serving entities (LSEs) or a non-profit public benefits trust. These parties would sell allowances to generators in the market and use the revenues to mitigate ratepayer impacts, either directly (in the form of consumer rebates) and/or indirectly through the support of programs that improve end-use energy efficiency.[2] The use of these revenues by the parties selling allowances would be managed in the public interest through regulatory requirements (in instances where allowances are allocated to LSEs) or public oversight of unregulated entities (in instances where allowances are allocated to non-profit organizations).

The primary argument for a public benefits allocation, as demonstrated by economic theory and historic experience, is that in a deregulated electricity market ratepayers will ultimately bear the compliance costs of a cap-and-trade program whether allocations are granted for free or generators are required to purchase allowances. Grandfathering allowances, therefore, results in a significant transfer of wealth from ratepayers to generators without lowering the impact of an emissions cap on wholesale electricity prices. This wealth transfer is expected to be considerably larger than those realized through existing cap-and-trade programs addressing sulfur dioxide and nitrogen oxides emissions.

The argument for a public benefits allocation is supported by two key factors that make the context for a carbon cap-and-trade program different than that faced when designing the Acid Rain Program and NO_x Budget Program, which addressed sulfur dioxide and nitrogen oxides pollution, respectively:

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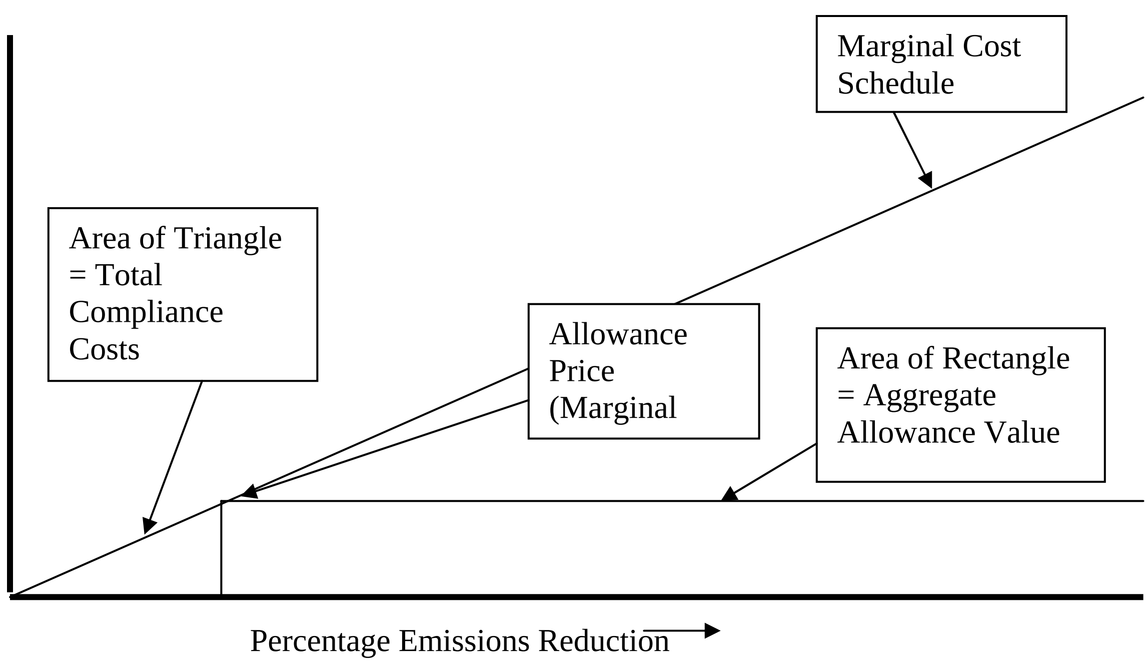
[1] Note that the Acid Rain Program auctions approximately 2.8% of allowances to facilitate price discovery. However, the revenue from this auction is returned to generators on a pro rata basis.
[2] Revenue from allowances could also be used to fund additional carbon reduction initiatives, such as expansion of renewable energy deployment or afforestation (tree-planting), although increasing support for end-use energy efficiency has been identified as a priority to support the success of a carbon cap-and-trade program.

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

- The Acid Rain Program and NO_x Budget Program envisioned significantly larger reductions, on a percentage basis, than an initial carbon cap-and-trade program is likely to require. As a result, the size of the allowance budget relative to current emissions at the onset of the programs was smaller than that envisioned for a carbon cap-and-trade program. In a cap-and-trade program, the compliance costs necessary to meet a cap result in a marginal cost of emissions reductions; this marginal cost is also the cost of allowances in the market. In a criteria pollutant program envisioning 50% reductions, the aggregate value of the allowance budget may be more than twice the total cost of compliance. In a carbon cap-and-trade program envisioning smaller initial reductions (e.g., 5%-10% relative to current emissions), the value of the emissions budget relative to compliance costs may be as much as twenty times that of compliance costs (Figure 1). Thus, a carbon cap-and-trade program presents a fundamentally different economic system than past cap-and-trade programs, with significantly different economic equity impacts than past programs.

- The Acid Rain and NO_x Budget programs were developed prior to the widespread advent of electricity restructuring.[3] These programs were developed in the context of cost-of-service regulatory regimes. Under cost of service regulation, public utility commissions could prevent integrated electric power companies from passing on the "opportunity costs" of grandfathered allowances to electricity ratepayers. In a competitive generation market, generators will pass on the value of allowances as a cost of generation, whether these allowances are given away or generators are required to purchase them in the market. Regulators do not have the authority to prevent such an outcome in a restructured electricity sector.



[3] A NO_x budget for the OTC region was established in June 1995 and the Phase I cap-and-trade program began in 1999. The Phase I cap-and-trade program for the Acid Rain Program began in 1995; Phase II of the program began in 2000.

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Figure 1. Illustrative Value of Emissions Allowances Relative to Total Compliance Costs for a Carbon Cap-and-Trade Program

Generators Pass on the "Cost" of Free Allowances
In a deregulated wholesale market, the independent system operator (manager of both the power grid and power market) solicits bids for generation to meet expected future electricity usage (electric load) on an hourly basis. Bids are accepted based on price and amount of available generation, until the expected load is met. The price of the most expensive generator that must dispatch its electricity to meet system load is considered the marginal unit and sets the market-clearing price. All generators receive this market-clearing price, even if their generation costs are significantly lower than the marginal unit.

In a competitive market, generators subject to a cap-and-trade program factor in the cost of grandfathered allowances into their bid price, since these allowances have a value and can be sold in the allowance market. The decision to generate would use up allowances, and therefore imposes an "opportunity cost"; allowances that are expended cannot be sold in the market and therefore potential revenue is lost.

The cost of complying with a carbon constraint will increase the cost of wholesale power, since fossil-fired units are typically the marginal unit. This increase in wholesale power prices will increase revenue for all generators, even those that are not subject to the cap-and-trade program.[4] Many generators subject to the cap-and-trade program may be able to fully recover their compliance costs through this increase in revenue. To the extent that the increase in wholesale market-clearing price exceeds their own increase in generation costs (to comply with the cap), these units will see an increase in net revenues. This dynamic is also evident for companies that own a portfolio of units, both fossil and non-fossil. A loss in net revenue at one plant may be counter balanced by an increase in net revenue at another plant, and may provide an increase in net revenue for the company as a whole.

Despite the potential uncertainty in net revenue impact for individual generation plants, since the aggregate value of carbon allowances is expected to be several times the value of aggregate compliance costs, grandfathering of allowances will provide a significant increase in net revenues for the generation sector as a whole.

[4] Note that this dynamic assumes a competitive market equivalent to a spot market. The use of bilateral, multi-year contracts may mitigate this impact somewhat in the short-term. However, an increase in spot market prices will impact the negotiated price of future bilateral contracts in the mid-term. The expected impact of a future carbon cap-and-trade program may also increase the price of these contracts prior to the beginning of the first compliance period of the program. There may be a rationale for grandfathering a portion of allowances to generators to account for these market dynamics, as well as market imperfections and localized market impacts.

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Rationale for a Public Benefits Allocation: Not All Emissions Are Created Equal

Technical Rationale
While previous cap-and-trade programs were developed in the context of emerging commercial end-of-stack pollution controls, with reduction targets developed in large part based on the cost and performance of these control technologies, there are currently no commercially available controls to reduce CO_2 emissions. Absent such controls, compliance options are primarily limited to fuel switching, improving power plant efficiency (heat rate improvements), environmental dispatch of existing plants (to reduce emissions on a portfolio basis), repowering, and shutdowns. In contrast, improving end-use efficiency is a low-cost means of both reducing CO_2 emissions from the generation of electricity and reducing peak demand, which reduces the need for future power plant construction. Reductions in peak demand also produce significant additional benefits that improve the reliability of the power grid.

Due to the nature of CO_2 as a pollutant and the lack of end-of-stack controls, integrating improvement in end-use energy efficiency into a generator-focused cap-and-trade program is significantly more important to program success compared to programs designed in the context of commercially available end-of-stack pollution controls. Reducing load growth will significantly reduce allowance prices.[5] Previous cap-and-trade programs have attempted to provide limited support for end-use energy efficiency through small set-asides. However, these attempts have met with limited success, with set-asides significantly under subscribed because applicants faced high administrative cost relative to limited economic benefit. A public benefits allocation could provide unprecedented integration of support for end-use energy efficiency into a generator-focused cap-and-trade program design.

Policy Rationale
Given the aggregate value of allowances relative to compliance costs in previous cap-and-trade programs, as well as the limited progress of restructuring at the time of program development, the transfer of wealth from ratepayers to generators was relatively limited. As a result, the policy calculus of which parties to grant allowances to was primarily focused on generator concerns. Given the differences of a carbon cap-and-trade program, the policy calculus required to successfully implement such a program may also be significantly different. A public benefits allocation would allow program designers to consider the needs of various ratepayer constituencies without necessitating the need for an auction of allowances by the regulating entity. These constituencies include large electricity consumers in the industrial and commercial sectors, as well as low-income consumers in the residential sector.

Recycling of revenue to support end-use energy efficiency could also mitigate any projected job losses due to increases in electricity prices, and could possibly result in net job increases. Revenue transfers to the end-use sector create more jobs than transfers to the generation sector, since more jobs are created through projects that reduce electricity demand than are created through the generation of electricity from conventional power plants. In addition, a larger

[5] See, for instance, modeling in support of the Regional Greenhouse Gas Initiative (RGGI), available at http://www.rggi.org/documents.htm

percentage of revenue dedicated to improving end-use energy efficiency would remain in the states where the ratepayer resides. By comparison, a significant portion of revenue transfers to generators would leave the state in which the ratepayer resides, in the form of shareholder earnings.

Incorporating End-Use Energy Efficiency into Cap-and-Trade Program Design

Given the significant impact of reducing electricity load on CO_2 emissions from the electric power sector, there has been a good deal of discussion of how to incorporate end-use energy efficiency into a carbon cap-and-trade program focused on electric generators. One of the recommendations is to increase spending on state energy efficiency programs funded through ratepayer system benefits charges (SBC). While increasing support for energy efficiency is projected to lower the costs of meeting a carbon cap, increasing SBC funds would create additional direct ratepayer impacts beyond those realized through a carbon cap-and-trade program.

Funding an increase in state energy efficiency programs through a public benefits allocation would not impose additional costs on ratepayers, since it would be funded through carbon allowance revenue. This would allow for significantly increased support for state energy efficiency programs on a revenue-neutral basis, in comparison to a program that gave allowances to generators for free.

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Clarifying Questions 2a:

Technology R&D and Incentives

- What level of resources should be devoted to stimulating technology innovation and early deployment?
- What portion, if any, of the revenues from permits or the auction of allowances should be reserved for technology development? If some portion is reserved for this purpose, should that set-aside flow to the federal government with funds spent through the traditional appropriation process? Or should the funds be allocated directly to a non-profit research consortium, chartered by the federal government, which would then administer technology development and deployment projects? Or should there be some combination of these two options?
- What criteria should be used to determine how such funds are spent and which projects are chosen?
- What other mechanisms should be used to promote technology deployment? Options include tax credits, cost-sharing for demonstration projects, assistance to state energy programs, etc.

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Clarifying Questions 2b:

Adaptation Assistance

- What portion of the overall allowance pool should be dedicated to adaptation research or adaptation-related activities?
- How should these allowances or funds be administered?
- What is the appropriate division between federal vs. regional, state, and local initiatives?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Clarifying Questions 2c:

Consumer Protections

- What portion of the overall allocation pool should be reserved to assist consumers?
- Should funds from the sale of permits or allowances be targeted primarily to low-income consumers, or should they be more widely distributed to benefit all consumers?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Clarifying Questions 2d:

Set-Aside Programs

- What portion of the allocation pool should be reserved for the early reduction credit program and the offset pilot program?
- Are other set-aside programs needed?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Clarifying Questions 2e:

Special considerations for fossil-fuel producers?

- Would some upstream fossil fuel producers be unable to pass the cost of purchasing permits or allowances through in fuel prices if they are the regulated entity?
- Is there a sufficient policy rationale for addressing these costs to justify the complexity of setting up and administering an allocation system for these entities?
- What other options exist to address the inability of fossil fuel producers to pass through these costs?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Clarifying Questions 2f:

Allocations for downstream electric generators?

- Should electricity generators be included in the allocation if they are not regulated? (Clarification: We mean to ask if an electric generator should be included in the allocation if the greenhouse gas regulation occurs at a point of regulation that is upstream or downstream from the generator, but not the generator itself.)
- What portion of the total allocation should be granted to the electric power sector? Should it be based on the industry's share of greenhouse gas emissions or some other factor?
- Should generators in competitive and cost-of-service markets be treated differently under an allocation scheme?
- How should permits or allowances be distributed within the electric sector? Should it be based on historic emissions? Electricity output? Heat input?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Clarifying Questions 2g:

Allocations for energy-intensive industries?

- Is there a sufficient policy rationale to have an allocation to selected energy-intensive industries? What industries should be included in the allocation?
- What portion of the overall allocation framework should be reserved for these industries?
- What are the appropriate metrics for determining allocations across different industries?

Please begin your response HERE. (no page limit)

Question 2. Allocation
Submitter's Name/Affiliation: Jeanne Fox, President, New Jersey Board of Public Utilities

Clarifying Questions 2h:

Allocations to other industries/entities?

- What other industries/entities (e.g. agriculture, small businesses, etc.) should be considered in the allocation pool?
- What should be the basis for their share of the total allocation as well as for the distribution among such industries/entities?

Please begin your response HERE. (no page limit)

Resources for the Future

Submitter's Name/Affiliation: Billy Pizer/Resources for the Future
Contact:
Email: pizer@rff.org
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The eventual design of mandatory, market-based limits and incentives on emissions of greenhouse gases will have consequences for everyone who makes or uses energy – that is, everyone in the economy. Economists typically examine these design questions in two dimensions: efficiency (getting the most environmental benefits at the least cost) and equity (who bears the cost). To a large extent, the underlying choice of an emissions trading program provides assurances of efficiency, leaving one to focus primarily on equity. This focus on equity places a premium on understanding the distribution of economic impacts associated with a particular program configuration – even before thinking about alternate allocation schemes. It is also important to understand that some allocation choices can affect efficiency, as well as that certain practical constraints have efficiency consequences, such as regulation in the electricity sector and the potential for emissions leakage into regions of the world not currently facing any emission limits.

In practical terms, it is possible to make a number of useful observations.

1. Economywide coverage provides greater efficiency and spreads the costs of the policy more broadly.
2. Except for its impact on coverage, the choice of upstream or downstream regulation is unlikely to have any impact on who faces what impact from the policy *assuming* allocation and point of regulation choices are entirely distinct.
3. The distribution of impacts is complex, depending to a large extent on how easily higher fuel prices are passed down the line to end-users and households, as well as on how those changes in prices affect product demand. This is further complicated by both trade in competitive international markets as well as regulation in domestic product markets.
4. Allowance allocations that are regularly updated based on output can be used to attenuate output price changes. While this approach is considered inefficient because it distorts prices and the incentive to mitigate across alternate opportunities, such distortions may have desirable distributional consequences that are difficult to achieve through other means precisely because of the price effects.
5. The value of linking trading programs – that is, gaining access to the cheapest reductions anywhere in the world – depends on the relative importance of current mitigation efforts compared to other policy goals, such as technology development. For example, region with low allowance prices and technology incentives may not want to trade with a region primarily using high allowance prices to spur technology.
6. Successful engagement of developing countries will likely require both decentralized credit incentives for mitigation projects, as well as more centralized, strategic efforts at sectoral reform that recognize a country's development goals. Neither approach is likely to be "efficient".

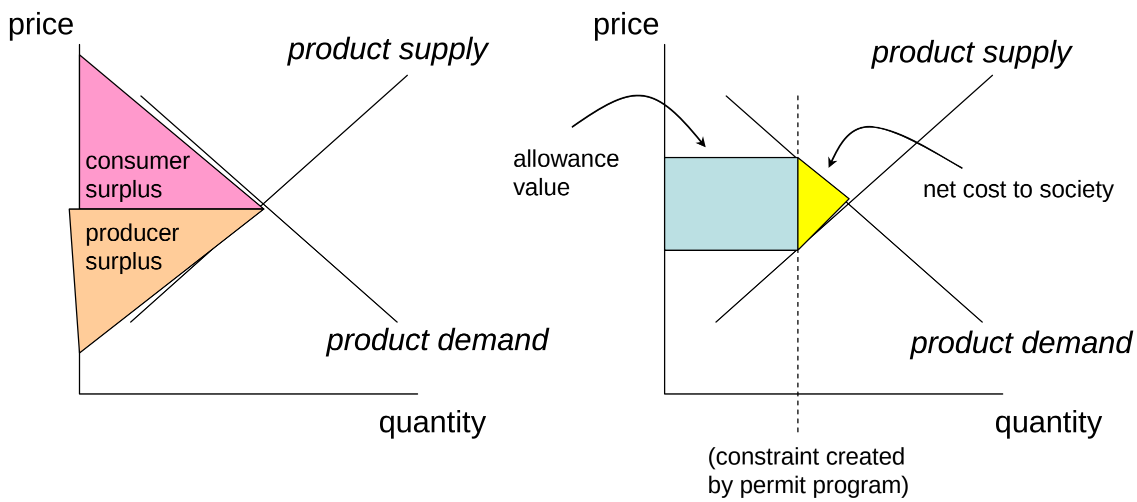
No mitigation benefits will arise if a policy cannot be enacted. Cost-saving but politically difficult design features need to be viewed on the basis of (a) relative importance, (b) likelihood that politics will change over time, and (c) potential to make policy adjustments over time.

William Pizer, Senior Fellow, Resources for the Future

Question 1: Who is regulated and where?

An upstream program provides maximal coverage with minimal administrative burden in terms of number of regulated entities. Economic theory and experience suggests that it does not matter who is regulated, except in terms of the aforementioned coverage and administrative costs – as long as allocation is kept separate.

On the theory side, environmental regulations put a price on environmentally damaging activities – emitting carbon dioxide – and create a divergence between the price seen by suppliers (e.g., fossil fuel producers) and users (e.g., fossil fuel users). In the diagram below, introduction of the environmental constraint in the right panel reduces the equilibrium quantity, raises the price to consumers and lowers the price to producers. This divergence creates the value associated with emission allowances. That value comes from a loss of consumer surplus (the difference between the consumer value of each unit and its price) and producer surplus (the difference between the price and the producer cost of each unit).



Importantly, the results of regulation do not depend on who has the regulatory obligation to surrender allowances – the producer or the consumer of the good (e.g., fossil fuel). The constraint looks the same and the price effects for both are the same – so long as the same markets are covered in both cases.

The weaknesses associated with an upstream point of regulation include (a) lack of experience of upstream producers; and (b) general discomfort with something different than previous programs (especially if allocation is believed to likely follow the point of regulation). These concerns must be weighed against both the lost efficiency from excluding sources that would not fit into a downstream program (e.g., transportation) and the unequal treatment of different sectors, both of which could be exacerbated in the future.

The lost efficiency due to more limited coverage under a downstream program, relative to an upstream program, is unclear, especially because the transportation sector generally does not yield as much emission reduction at any given price. However, alternate policies like (CAFÉ) performance standards have the additional weakness that they do not address the intensive margin; that is, how much a (better performing / higher efficiency) vehicle is used. While the incentive to reduce emissions though higher mileage vehicles could be tied to emission mitigation in other sectors via trading, it would not create any incentive to drive less.

Transport and other sectors not covered in a downstream program could, alternately, be taxed at the safety valve rate. This would address the aforementioned concerns but might not be any more politically salient.

A third possibility that has arisen – namely the downstream regulation of coal and upstream regulation of oil and natural gas – does not seem to offer any advantages or disadvantages over a fully upstream program in terms of coverage or administrative costs. There are comparable numbers of mines and end-users of coal, with few small users (and possibly more small suppliers). The one caveat would be if somehow regulated utilities saw allowance allocations or costs treated differently by PUCs when the cost of the allowance is paid separately versus associated directly with the fuel cost. And, of course, this equivalence result assumes that point of regulation is not used to argue for otherwise different allowance allocations to downstream coal users.

William Pizer, Senior Fellow, Resources for the Future

Question 2: Should the costs of regulation be mitigated for any sector of the economy through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?

Economics has long demonstrated that the net costs to society can be reduced – and efficiency improved – if allowances are auctioned and the revenue used to cut other taxes. This is effectively marrying environmental policy with a small dose of tax reform, offsetting some of the regulatory cost with a gain from the reform. This is, in fact, how the UK Climate Change Levy was administered.

In general, however, environmental regulation, like tax reform, is often driven by distributional concerns. Indeed, nothing is stopping us from implementing dramatic improvements to the tax system *except* distributional concerns. So it should not be surprising that most discussions of allowance allocation focus on free distribution.

A couple of important points are worth noting before going further.

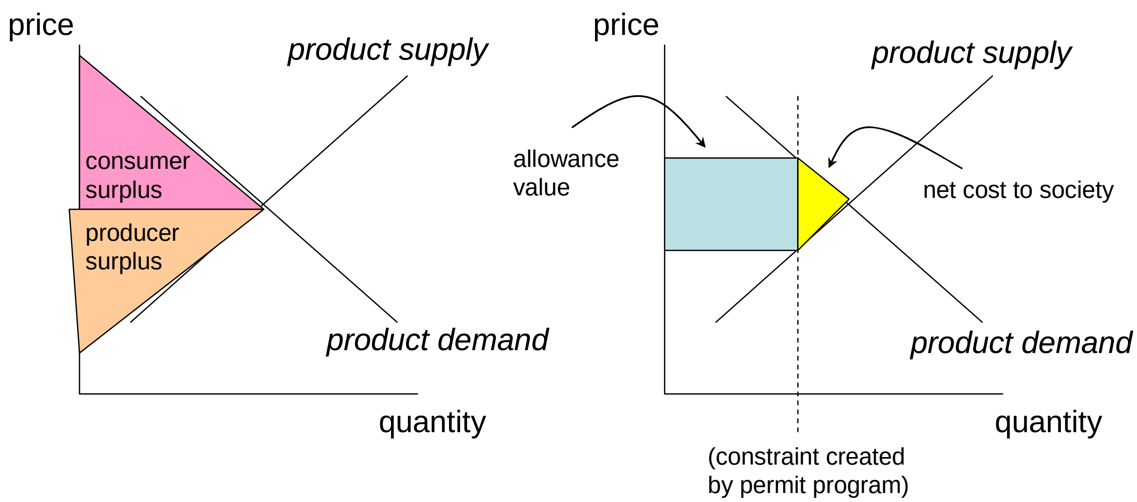
First, the direction of climate policy in the U.S. suggests that market-mechanisms are unlikely to occur at levels that will significantly spur technology development on their own – yet this must be the principal goal of climate policy. Therefore, technology development and deployment funding and incentives must also be a key element of domestic climate policy. While economists frown upon the idea of earmarking revenue from one source for spending on another (because it fails to hold all spending to the same standard), there may be no other way to provide the necessary level of stable funding to support technology development. Good arguments can be made for auctioning a portion of the allowances to support technology development.

Second, while we are likely to have some good ideas about near-term allocation decisions, it becomes increasingly difficult (to me) to think about how allocations ought to be handled in the long run. Yet, if no provisions are made now, future participants will come to expect the same as current participants; such expectations are exceedingly hard to break. Therefore, there would seem to be good arguments for a gradual *transition* to an auction over a long period of time. Or, rather, a transition away from whatever the initial allocation looks like, with the idea that future allowances might again be freely allocated but based on a fresh look at the problem.

Returning to the issue of who should get free permits, a key issue must be to understand what impacts are born by what constituencies. That is, who is really *burdened* by the policy and how might allocations *alleviate* or rebalance that burden.

As suggested by the figure below, showing the consequence of regulation in a previously unregulated market, the principal burden can be born either by the producer or the consumer. This burden does not depend on where the regulation occurs (either producer or consumer of the good), but on how prices are likely to change.

William Pizer, Senior Fellow, Resources for the Future



In this figure, the burden is born in roughly equal proportion by suppliers and users.

Note that the net cost to society (triangle in right panel) is potentially quite small compared to the allowance value (rectangle in right panel), which will be seen to some as a cost. While the net cost depends on the change in production, the increase in price to buyers and potential decrease in price to sellers reflects a *transfer* to whoever receives allowances. If those allowances are given out carefully, it can greatly ameliorate the costs of a program perceived by affected parties.

Note also that the change in prices is related to the change production – the only way production can change is for suppliers to see slightly lower prices and purchases to see slightly higher prices. Importantly, it may be quite difficult to get those affected by a regulation to agree on how their prices are likely to change.

Evidence from virtually all EIA analyses of various carbon trading programs, however, suggests that price received by producers of fossil fuels (coal, oil, and gas) is unlikely to change very much. That is, with the exception of changes in quantity (particularly coal), the impacts of a carbon dioxide emissions trading program are likely born *downstream* from the producers of fossil fuels – regardless of where regulation occurs – by fossil fuel consumers or even further down the fuel chain.

How do impacts get passed further down the fuel chain? Because this picture is further complicated by the fact that consumers in this, regulated market may not be households but, in fact, producers in yet another market – for example, electricity or cement. As they see increased costs in the carbon/fossil market, they may or may not be able to pass on those costs to their consumers. This will typically depend on the competitiveness of their output market and, more specifically, on whether they compete with unregulated foreign producers. Or, it may depend on whether they instead sell product (say electricity) into another *regulated market.*

Quantitative or at least qualitative analysis is necessary to understand where price increases start and finish in this chain and therefore where the burden of the policy falls.

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The economists' approach, at this point, would be to freely distribute allowances to those impacted by the policy based on society's interest in rebalancing those impacts. This might include businesses who see their bottom lines slightly worsen, or households who see slightly higher energy bills (particularly low income households).

Typically, the economists' approach is to base this distribution – and all subsequent distributions – on some already historic calculation. Otherwise, if businesses and individuals know that future distributions depend on their behavior, the distribution itself will become an incentive for that behavior. This is typically viewed as inefficient because it tends to raise costs of a given target (or reduce the reductions at a given cost) relative to the case with un-attenuated price effects from the trading program.

There are at least two cases where one might consider an updating allocation based on output despite apparent economic and efficiency arguments against it. First, in cases where a firm competes internationally, and must sell at a price set in international markets, an updating allocation would provide an incentive to continue producing domestically. Even if such a firm is given allowances freely, without tying the allocation to the level of output, the firm will see incentives, at the margin, to reduce domestic production in favor of foreign, unregulated production. While such a shift might reduce domestic emissions, it clearly is not efficient as those emissions will appear elsewhere. Hence, the updating allocation makes sense (until the world market is regulated).

The second case could be in electricity markets facing both regulated and deregulated circumstances. The idea would be that regulated markets will see small price increases anyway because of the regulators ability to require utilities to pass through the benefits of any free allocation – if there is any free allocation. There is no way to require that passthrough in a competitive market, but one could attenuate the impact on electricity prices by tying future allocations to the output level. This would need to be carefully designed, but could have the desirable consequence that climate policy would not be set up in a way to distort any future choices about re-regulation or deregulation in the electricity markets.

William Pizer, Senior Fellow, Resources for the Future

Question 3: Should a U.S. system be designed to eventually allow for trading with other greenhouse gas cap-and-trade systems being put in place around the world, such as the Canadian Large Final Emitter system or the European Union emissions trading system?

There is no question that in a system exclusively designed to reduce emissions now, linkage with other systems would provide overall gains to both systems. However, two caveats are in order.

Even with an exclusive focus on emission reductions, and a clear overall gain to both systems, there are likely to be losers and winners within each system – perhaps far more significant than the overall gain. Price increases in a low price system benefits allowance holders and hurts anyone purchasing allowances or sitting downstream of a purchaser. Price declines in a high price system have the reverse effect, benefiting buyers and hurting sellers. Therefore, the overall gain from linking and equalizing prices must be weighed against internal distributional consequences.

Of course, linking systems with basically the same price would avoid such effects and, indeed, harmonizing prices before linking might be viewed as a useful first step.

Note that this ignores technical issues about whether one system has a safety valve, banking, borrowing, and other features that might not be fully compatible across systems.

Beyond this distribution question, it is also important to recognize that near-term emission reductions are only one piece of the climate policy objective – the larger goal is technology development and deployment to reduce emissions and mitigation costs in the future. To this end, the gains from linking must be weighed against how equalizing price across systems affects these larger policy objectives.

William Pizer, Senior Fellow, Resources for the Future

Question 4: If a key element of the proposed U.S. system is to “encourage comparable action by other nations that are major trading partners and key contributors to global emissions,” should the design concepts in the NCEP plan (ie, to take some action and then make further steps contingent on a review of what these other nations do) be part of a mandatory market-based program? If so, how?

The key to developing country action is likely to be a two-pronged approach. On the one hand, market-based incentives in the U.S. should be structured to provide decentralized, project-level credit, for desirable actions in developing countries. These credits need not follow one-for-one accounting on emissions, but should be linked to the overall desirability of the actions and be somewhat constrained, initially, (either by eligibility, credit level, or explicit limit) in order to prevent volatility in the U.S. trading program until the availability of such credits becomes more predictable.

Alongside this decentralized, market-based approach, there needs to be strategic efforts in conjunction with major players in major developing countries to find ways to meet development goals in the most climate friendly manner. These might involve efforts to make nuclear power accessible, to encourage natural gas use over coal, or to encourage more efficient coal over less efficient coal. Such actions are more likely to be the outcome of a government quid pro quo than a response to credit incentives a project or even sectoral level.